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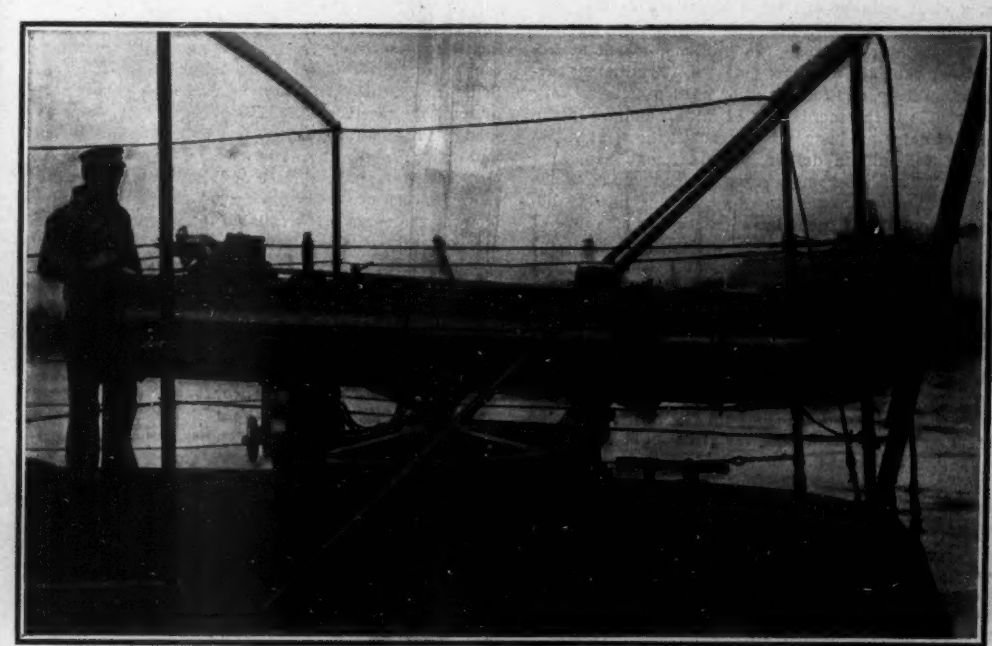
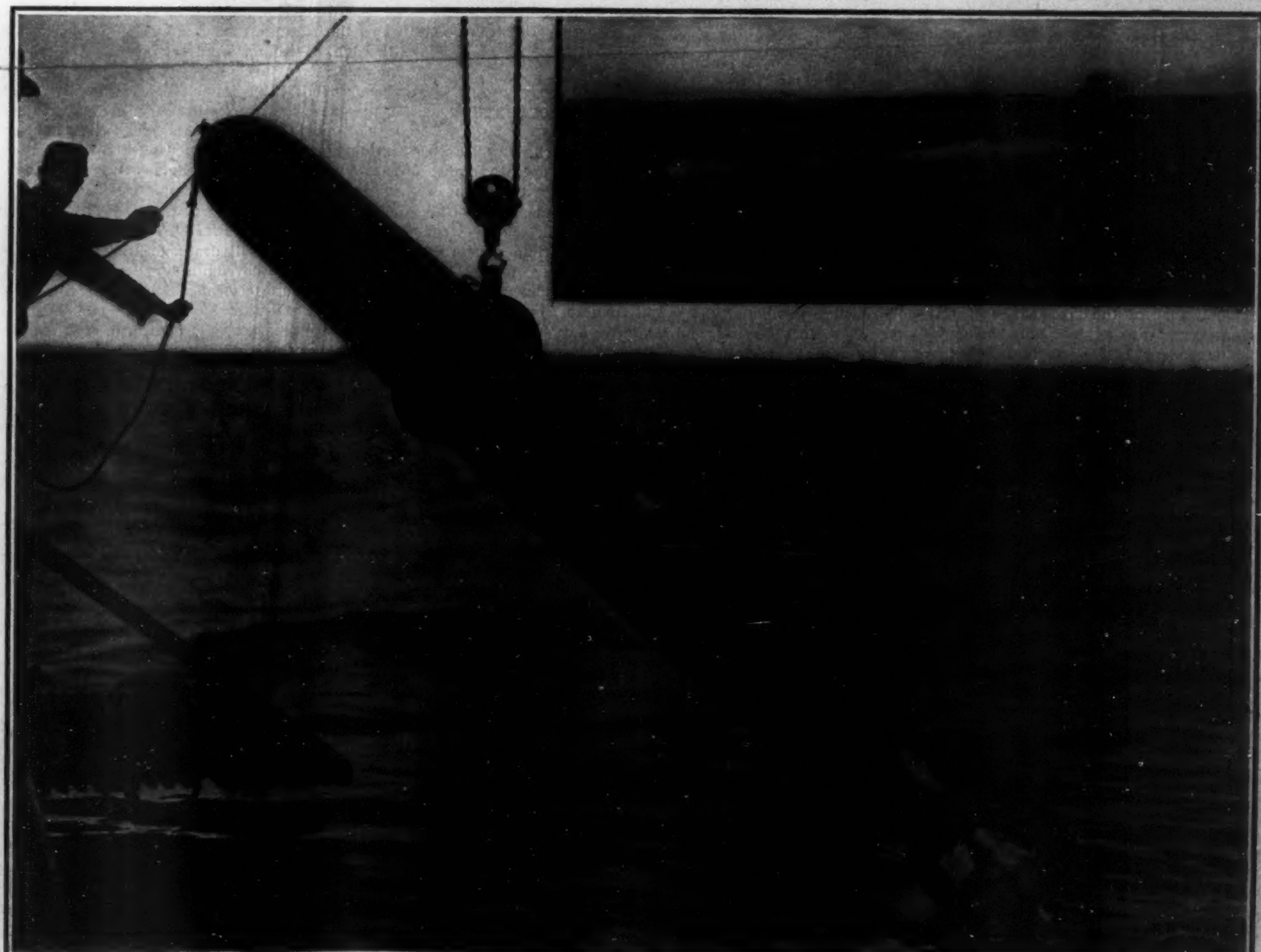


Torpedo in Tube Ready for Launching.

One of the Turbine Wheels.



Torpedo in Mid-Air, as It Leaves the Launching Tube.

Hoisting a 21-Inch Torpedo Aboard After a Trial Run.

NEW 21-INCH TORPEDO FOR THE UNITED STATES NAVY. SPEED, 36 KNOTS AT 1,000 YARDS RANGE.—[See page 7.]

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ESTABLISHED 1845

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NEW YORK, SATURDAY, JANUARY 6, 1906.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE PASSING OF THE "OREGON."

And now it is the "Oregon" that has to go the way of all battleships, and pass from the first to the second line of defense, to do duty in home waters. This announcement will occasion not a little sentimental regret among the American people, who will ever bear in mind the long voyage of this battleship from the Pacific coast to Cuba, and the brilliant part which she played in the chase of the Spanish squadron on its flight from Santiago harbor. It seems but a few years ago that the ships of this class ("Oregon," "Indiana," and "Massachusetts") were heralded as the most powerfully armed and armored battleships afloat. The claim was well made; for not even the big British ships of that day could match the combination of four 13-inch and eight 8-inch guns and 18-inch face-hardened armor found in the "Oregon" class. Yet these vessels possessed inherent defects as naval design and construction advanced, which were bound to tell against them. Chief among these was the fact that their displacement of something over 10,000 tons was altogether too small to effectively carry such a powerful aggregation of offensive and defensive elements. For in order to float such guns and armor at all, it was necessary to keep down speed, coal supply, and the supply of ammunition, to a point which was bound ultimately to render these ships unable to remain in our first line of defense. The trend of later battleship design is in the direction of giving a ship high freeboard, large displacement, and a generous supply of ammunition and coal, and the increased displacement of about sixty per cent of such a vessel as the battleship "Connecticut" over the "Oregon" has been given mainly to these features. The main battery of the "Connecticut" in numbers and weight is no greater than that of the "Oregon," consisting of four 12's and eight 8's as against four 13's and eight 8's. In the secondary battery there is an increase from four 6-inch to twelve 7-inch guns. The vastly greater power of the broadside is mainly due to the great increase in velocity, range, rapidity of fire, and energy of the guns. The length of the ships has gone up from 348 to 450 feet; the breadth from 69 1-3 to 76 2-3 feet, while the depth, on the other hand, has been reduced from 28 to 26¾ feet, a most important advantage for the later ships. Displacement has increased from 10,288 tons to 16,000 tons, and the speed has risen from 16 knots to 18. The normal coal supply has risen from 400 tons to 2,000; and although the "Oregon" is credited with a bunker capacity of 1,450 tons as against 3,200 tons for the "Connecticut," she cannot take on that amount without practically submerging the whole of her water-line armor. In the second line of defense, however, for service in home waters, the "Oregon" still has a useful life of many years' service before her, and in the naval annals of the country she is destined to be placed high on the roll of honor.

WEALTH OF OUR FARMS.

In view of the vast increase that has taken place during the past decade in the number and wealth of our industrial establishments and in the value of our manufactured products, it will be surprising to many people to learn that our farms still greatly exceed in value and as a source of revenue every other source of wealth, not even excluding our great manufacturing enterprises. The wealth production of the farms of the United States reached in 1905 the highest amount ever attained in this or any other country, the total figure being nearly six and one-half billion dollars. Four of the crops reached new records as to value, namely, corn, hay, wheat, and rice. Corn exceeds previous yields both in amount and in price, and hay, wheat, and rice reached new figures as to value only. The general average of production was high in the case of every crop, and the prices ran higher still. The Secretary of Agriculture estimates that in addition to the enormous yield of wealth, the farms of the country have themselves increased in value during the past five years by over six billions of dollars; and he puts the matter dramatically when he states that with every going down of the sun during the past five years, there has been registered an increase of three million four hundred thousand dollars in the value of the farms of the country. An analysis of the principal crops for the year shows that corn reached its highest production with 2,708,000,000 bushels, a clear gain of 42,000,000 bushels over the very profitable year of 1899. The hay crop is valued at 605 million dollars; cotton at 575 millions; wheat at 525 millions; oats, 282 millions; potatoes, 138 millions; barley, 58 millions, and tobacco at 52 million dollars. Very remarkable is the increase of 54 million dollars in the value of dairy products, which reached the total valuation of 665 million dollars. The farmer's hen, says the Secretary, is becoming a worthy companion to the cow, the annual production of eggs being now 20 billions. Poultry products have climbed to a value of over half a billion dollars, so that poultry competes with wheat for precedence. The total value of horses is estimated at $1,200,000,000. There are over 17½ million milch cows, valued at nearly half a billion dollars. During the year farm produce to the value of 827 million dollars was exported. During the last sixteen years the domestic exports of farm products have amounted to 12 billion dollars, or one billion dollars more than enough to buy all the railroads of the country at their commercial valuation. Clear evidence of the prosperity of the farmer is seen in the fact that under a recent amendment of the national banking law, allowing the establishment of banks with a capitalization of less than $50,000, there have been 1,754 such banks established in the last year, nearly every one of which, says the Secretary, is located in a rural community and the capital furnished by farmers. For the first time in the financial history of the South, the deposits in that region exceed one billion dollars. Should there be no relapse from his present position as a wealth producer, three years hence the farmer will find that the farming element, which forms thirty-five per cent of the population, has produced an amount of wealth within the preceding ten years equal to one-half of the entire national wealth produced in three centuries.

SINGLE-PHASE LOCOMOTIVES ON DIRECT-CURRENT TRACKS.

The announcement that the New York, New Haven and Hartford Railroad intended to operate single-phase locomotives over the direct-current section of the New York Central lines, which lead into the new terminal station, elicited a strong protest from Mr. Sprague, the inventor of the multiple system of control. He expressed regret that the company had not adopted a system more in harmony with that which was being laid out at such vast expense by the New York Central, and his letter suggested that there would be certain difficulties of operation attending the introduction of the single-phase locomotive into the new terminal. In the course of a reply by the vice-president of the New Haven road, it is stated that the new electric engines ordered by his company are of the interchangeable type, and that they are expressly designed to operate under all practical conditions within wide limits. They will be able to use both alternating and direct, high-tension or low-tension alternating current, to take current from the third rail or from overhead conductors at heights varying between 14 feet and 22 feet; and to operate with equal facility on either or both of the two track levels at the Grand Central station.

It is stated by this official that on sections equipped for direct current the single-phase locomotives will operate in every respect as direct-current engines of high commercial efficiency, and on sections equipped for alternating current, they will show still higher efficiency. The public is assured that the adoption of this most flexible type of engine by the New Haven Company will introduce no new features or difficulties in the track equipment or operation of the Grand Central terminal, and will not entail upon the New York Central the necessity for the expenditure of an additional dollar nor the transposition of a wire.

Now, the above is all very good as far as it goes, which is not very far. If the event prove to be as good as the prediction, both the New Haven Company and the traveling public will be subjects for congratulation. The latter, and especially those New York commuters whose rare good fortune it has been to use the New Haven line, may be pardoned for their solicitude lest that company, in any steps that they might be taking that would affect their suburban service, were actuated more by considerations of their own profit than of the convenience of the traveling public.

WATER POWER AT HIGH PRESSURE.

One cubic foot of water per second, falling 1,000 feet, develops more than 11 horse-power.

This striking fact may well call attention to the great, undeveloped water powers in all of the mountainous sections of the United States. Hundreds of such powers now go to waste almost unnoticed, because of the common idea that a large volume of water is necessary where much energy is to be developed. As a matter of fact, many an unpretentious mountain brook expends enough power in grinding its rocky bed to turn the wheels of a great city.

Proof of this is easily reached by considering the figures for rainfall, runoff, and elevation that apply to large parts of the country. Take, for illustration, an annual fall of rain and snow that amounts to 36 inches of water on a level, and is generally reached in the higher parts of the New England, Middle, and Southern States. With this rainfall each square mile of territory receives 83,635,200 cubic feet of water annually. This water must either soak into the ground and reappear elsewhere in springs, or evaporate, or else run off over the surface of the ground, and a part moves in each of these ways. That portion which runs off over the surface is available for power production. If a quantity of water represented by a depth of one foot on a level runs off over the surface of the ground, each square mile furnishes 27,874,400 cubic feet annually. This volume of water develops some 86,700 horse-power hours, if allowed to fall 1,000 feet. On the assumption that the flow of water will be regulated, and used during only 3,000 hours per year, the runoff of a depth of one foot from one square mile will generate 28.9 gross horse-power during 300 days of ten hours each, under the conditions named. With any variation of the water head from 1,000 feet, the power will, of course, vary in like proportion. That is, a fall of 500 feet would develop 14.4 horse-power during 3,000 hours with the volume of water named, and a fall of 2,000 feet would yield 57.8 horse-power. So too the number of horse-power hours will vary directly with the total quantity of water available. The ratio of the volume of water passing down the bed of a stream to the volume that annually falls on its drainage area, known as the percentage of runoff, is very irregular in different cases, and ranges from less than one-tenth to fully seven-tenths. For many of the streams in the mountainous parts of the States along the Atlantic coast a runoff of 50 per cent is not too high. With an annual precipitation of 36 inches of water on a level, a runoff of 50 per cent gives a stream of 41,817,600 cubic feet of water per year from each square mile of its drainage area, or a discharge of 3.87 cubic feet per second during 3,000 hours. This rainfall and runoff combined with a fall of 1,000 feet thus yield about 129,900 horse-power hours for each square mile of drainage area. If this amount of energy is used at a uniform rate during 3,000 hours, it develops 43.3 horse-power. From these figures it may be seen that a small drainage area will often supply enough water to develop a very large power, if a head of 1,000 or more feet can be obtained. A small mountain stream will often have between one and two miles of drainage area per mile of length, even where located in a very narrow valley, so that the runoff from twenty to fifty square miles is available within a few miles of its source. With a drainage area of fifty square miles, the runoff on the basis of the above moderate assumptions would develop 2,165 gross horse-power during 3,000 hours per year, or 6,495,000 horse-power hours.

In order to make this energy available for useful work, there must in every case be a large storage capacity, because the fall of water is very irregular from day to day and month to month. Small streams in mountainous country often show maximum discharge rates that are twenty to fifty times as great as the minimum, and this great variation in the discharge gives such streams small value for power production, before a relatively large storage capacity is provided. Take, for illustration, the case assumed above, with a drainage area of fifty square miles and an annual runoff represented by a depth of 18 inches of water on a level over this drainage area. With most of the annual rainfall concentrated in the smaller part of the year, it might be desirable to provide a storage capacity for one foot depth of water on a level over the entire drainage area. This would mean the storage of fifty times 27,878,400 cubic feet of water, or 1,393,920,000 cubic feet. With an average depth of 20 feet in this reservoir, its area would be 2.5 square miles, or one-twentieth of the drainage area. Such a reservoir might involve only a moderate investment in a hilly country with deep valleys.

California and the entire Rocky Mountain region afford the best opportunities for the development of water power under high heads, because of the great changes in elevation there, and numerous examples of such powers are to be found in these sections. One such is the hydro-electric plant on Bear Creek that delivers energy to the 33,000-volt transmission that

runs to Los Angeles. At this plant the head of water is more than 1,900 feet, so that one cubic foot of water per second develops twenty gross horse-power. In Colorado, near Pike's Peak, an electric plant is operated with water under a head of 2,500 feet, which is believed to be the greatest in this country or the world, that has been developed. While such heads of water cannot, perhaps, be duplicated at developments in the East, numerous cities exist along the Appalachian chain of mountains, from Maine to Georgia, where water heads of 500 to 1,000 feet can be obtained for power plants. At a recent development in New England, a head of about 470 feet was procured for a pipe line some three miles long. The drainage area of the stream above the dam where the head of this pipe is located is only 15 square miles, and of this area the reservoir behind the dam covers 800 acres.

As there are 640 acres to the square mile, this reservoir covers 8.3 per cent of its drainage area. The storage capacity of this reservoir is 435,000,000 cubic feet, which represents a layer of water 1.01 feet thick on a level over its entire drainage area. In a case where the total drainage area is 24 square miles, the storage reservoirs cover 1,120 acres and have a combined capacity of 498,000,000 cubic feet of water. The generating station where the runoff from this 24 square miles is utilized under a head of 222 feet has a capacity of 1,600 kilowatts. Plans for a plant in the Berkshire Hills of Massachusetts, not yet built, show a water head of more than 800 feet.

THE DEVELOPMENT OF THE CAPITAINE PRODUCER-GAS MARINE ENGINE.

The application of the Capitaine producer-gas marine engine, the possibilities of which have been demonstrated in a very practical manner by the Thornycroft Shipbuilding Company, is being extensively developed in Great Britain. So far the utilization of this system of generating power has been confined to small vessels, the Thornycroft Company having only completed arrangements with the inventor to this end. The rights to manufacture and apply the invention to large vessels have been acquired by Messrs. Beardmore & Co., Ltd., who are carrying out some interesting experiments to this end.

This firm has under construction an installation of 500 horse-power, and this is by far the largest engine of this type that has been so far undertaken. Under these circumstances the construction of such an engine presents several problems that have not had to be encountered in the case of the smaller-powered plants. Yet there is a great opening for this type of engine, not only for propelling purposes, but for auxiliary machinery purposes, especially where weight of machinery and economy in coal consumption are of vital importance. The total weight of such an engine is about 75 per cent of the ordinary engines and boilers, while the fuel consumption is 50 per cent less.

This 500-horse-power plant will comprise five cylinders of the vertical type, working on the Otto cycle principle, and fitted with a suction gas producer specially designed to work continuously with ordinary bituminous coal. The framing of the engine is of plate steel exclusively with the exception of the cylinders, which are the only large parts of cast iron. By means of this design a rigid yet light construction is obtainable.

The builders have also designed a new type of reversing gear, which possesses several interesting and novel features. This gearing will enable the engine to run in either direction and dispense with feathering propellers, bevel gearing, and so forth for reversing. The gas producer is also being arranged so as to supply the engines with gas free from tar, and is to be fired by a mechanical stoker so designed as to prevent the formation of clinker when using bituminous coal.

When this engine is completed, it will first be submitted to exhaustive and severe trials on land under conditions resembling as near as possible those obtained at sea. If they should prove satisfactory, it will then be installed upon a Glasgow coasting steamship, and the firm will then proceed with the construction of an engine of 1,000 horse-power, for which the designs have been prepared, but the construction of which has been postponed until the results of the 500-horse-power engine have been obtained, so that any disadvantages or weak points that may develop may be eliminated from the larger engine. The engine now in hand will be completed and tested within the next two months.

That there are great possibilities for this system of generating power is evidenced by the practical interest that is being shown in the invention by the British Admiralty, who are also constructing a high-powered engine at Manchester, and which will also be subjected to a series of severe trials by the naval engineers. If the invention can be proved to be as successful in the larger sizes as it has been in smaller craft, it has a great future as the power generator in large vessels, and especially in bucket dredges and towing craft, where a maximum of power is desired at the minimum of expense, both as regards initial cost, space occupied, weight, and economical coal consumption.

HYBRIDIZATION OF PLANTS.

BY W. R. GILBERT.

It is a singular fact that it is only during the past century that hybridization, or cross-breeding of plants, has been practised.

Lord Bacon, more than 300 years ago, seems to have foreshadowed it, but it was generations before anyone attempted to solve the mystery.

Lord Bacon wrote: "The compounding or mixing of plants is not yet found out, which if it were, it would be one of the notable discoveries, for so you would have great varieties of fruits and flowers yet unknown."

Who was the first to cross a fruit or flowers we have no data to prove, but Mr. Knight, of Chelsea, England, was very much interested in, and practised the art of hybridization. When the secret was found out the practice soon became common, and some enthusiastic amateur horticulturists engaged in it. Since then the art of hybridization has been followed by many, and, as Bacon suggested, greatly improved and unknown varieties of fruits and flowers have been produced in rich abundance.

Perhaps in the amelioration of fruit it has been important, now marvels of the hybridist's skill are crowding upon us, and they seem to accomplish their aims with a certainty that is remarkable—for instance, in the case of the stoneless plum which Mr. Burbank, of California, after twenty-five years of study and experiment has been able to give to the world, and now the coreless apple of Mr. Spencer. It has taken these gentlemen years to accomplish the object they had in view, but to raise a new grain, fruit, or flower or vegetable of greatly superior qualities is worth a lifetime of patient and persevering effort, because it contributes to the welfare of the human race, and the comfort of the lower animals.

Cross-breeding is the most important, useful and fascinating branch of horticulture and sometimes very remunerative.

In order to obtain a new variety it is only necessary to exercise some judgment, and select two parents of certain qualities which are of the same, or of very closely allied species, and cross them for a new intermediate variety, which will blend the good points of both, and thereby effect an improvement; thus an early, but insipid pear, if crossed with one of fine flavor, but lacking the desirable qualities as to habit of growth or productiveness, will be likely to bring a variety which in some essential points will surpass either of its parents.

The "Goe's Golden Drop" plum was raised by crossing the Green Gage with the Magnum Bonum plum; the Elton cherry was raised by crossing the Byarrean with the White-heart, and the combinations have produced the two invaluable fruits mentioned.

The power to cross-breed is limited by a wise provision of nature to prevent the generation of monstrosities. A cross-bred plant is a sub-variety raised between two varieties of the same species. Some nearly allied species are capable of fertilizing each other and these are pure hybrids or mules, and, like animals so bred, are incapable of producing perfect seed. No one has ever succeeded in causing the pear to fertilize the apple, or the gooseberry the currant. Before people were so well informed on these subjects as they now are it was believed that wonders could be brought about by fertilizing an orange with a pomegranate or a red rose with a black currant, but these fancies are no longer accepted as being possible.

Now, as to the *modus operandi* of the artificial crossing of plants. Take the blossom of a cherry, for an example, which is directly connected with the embryo seed; the numerous surrounding threads are the stamens at the summit of which are little sacks which secrete the powder called pollen. The pistil has its base in the embryo fruit and at its summit is the stigma; the pistil is also called the style, and is the stalk or tube between the ovary and the stigma; on this stigma is a sticky substance, when it has arrived at maturity, to which the pollen adheres and thus the seed is fertilized. Now, if we fertilize the pistil of one flower with the pollen of another we shall obtain a variety with the characteristics of both parents.

The process of obtaining cross breeds is easily performed. When the tree blooms, which we intend to make the mother of the improved race, we select one of the blossoms not fully expanded; with a pair of sharp scissors we cut off the antlers or pollen sacks. As soon as the blossom is fully expanded, collect with a camel-hair brush the pollen from a fully blown flower taken from the tree we intend to be the male parent. Apply the pollen, and leave it upon the point of the stigma. It is safe to cover the flower thus operated upon with a bag made of thin gauze to prevent insects getting beforehand with us in applying the pollen. To sum up, the two essential points are: First, to be very careful to remove the antlers before they are sufficiently mature to have fertilized the pistil; second, to apply the pollen when it is in perfection, that is, dry and powdery, and when the stigma is moist and in condition to assimilate it. Seedless fruit is produced by removing the pistil before it has been pollenated, so that the fruit will form and contain but few if any seeds, and by selecting those which have the least seed and repeating the process in course of years seedless varieties will be the result.

SCIENCE NOTES.

For the purposes of studying the causes of sorotchte or mountain sickness, and the influence of the temperature and climate of high altitudes upon general nutrition, two eminent French medical authorities, Drs. Guillemard and Moog, during last July made a stay at the Mont Blanc observatory with the astronomer M. Janssen. According to the results of their investigations the diminished tension of the oxygen of the atmosphere clogs the process of oxidation, and this sets up an elaboration of toxic substances, the retention of which causes symptoms of autointoxication and accounts for the symptoms of mountain sickness. Acclimatization, however, results in a few days, and the symptoms pass away under circumstances resembling those accompanying the passing of the crisis in infectious maladies.

In the northern hemisphere the greatest cold seems to have been observed at Werchojansk, in Siberia, where it is stated that the thermometer goes down as low as —69.8 deg. C. However, according to the information which has been brought by the Russian artist Borrissoff, certain parts of Nova Zembla seem to show at least as low a temperature as the above. The Bulletin of the Société Astronomique states that in an excursion which M. Borrissoff made lately in the Strait of Matotchkin, he discovered underneath a case a box containing two thermometers, one a maximum and the other a minimum-recording thermometer. It is supposed that these instruments belonged to Höfer, an Austrian geologist, who made an expedition to this spot in 1872. One of the thermometers was found to have registered the temperature of +15 as a maximum, while the second instrument showed that the greatest cold had been —70 deg. C. This value seems to be the extreme cold which has been reached in this region for thirty years past.

The variations in the thickness of the hair upon the same individual have been studied by the Japanese scientist Matsura and he makes some interesting observations. It is known that in certain diseases we find among other differences of growth, very marked variations in the growth of the finger nails both in length and thickness. It is found that the hair is also influenced, and all the affections which act upon the general health bring about a diminution in the thickness of the hair. The medullary layer may even be interrupted and the hard layer which it contains may disappear. Observations made upon a hair will therefore show the variations in thickness according to certain maladies and the length of the affected part or the thinner portion of the hair gives an idea of the duration of the malady, and even of slighter affections. The variations are naturally more strongly marked in the case of coarse-haired races than for others. Provided the hair had never been cut, the subject would have his pathologic history written, so to speak, in capillary terms.

A new process for the manufacture of hydrogen gas has been brought out in Europe not long ago, and is designed to replace the usual method of sulphuric acid and iron or zinc. In the new process the reaction of the alkaline hydrates upon metallic aluminium is utilized. This reaction is $2Al+3NaOH=3H+AlO_3Na_3$. When once commenced, the metal is attacked by the soda solution with great energy. The gas is produced very rapidly and the liquid heats up to the boiling point. Theoretically we need 0.810 kilogramme of aluminium and 3.6 of caustic soda to produce 1 cubic meter of hydrogen, but in practice owing to the impurities in the metal and the soda, we require 4.68 kilogrammes of caustic soda. The process gives some advantage as to saving in material which is to be transported, seeing that we need but 5 kilogrammes of material per cubic meter of gas, while the acid process takes 7 kilogrammes. But the cost of production is much higher and comes to at least $0.72 per cubic meter. This process was used by the Russian aerostatic corps during the recent war.

An interesting effort to apply the Parsons turbine to locomotive propulsion is being made by Mr. Hugh Reid, a well-known British locomotive engineer. This inventor has designed a self-contained electrical locomotive, which will generate its own current by means of a boiler and a condensing Parsons turbine. He has also devised an air-cooled condenser of somewhat novel design for use with the same, and the forthcoming experiments with this locomotive are being anticipated with great interest by British engineers.

A NEW DETERMINATION OF THE QUITO ARC OF THE MERIDIAN BY THE FRENCH GEODETIC COMMISSION OF ECUADOR.

BY JACQUES BOYER.

At its meeting at Stuttgart, in 1898, the International Geodetic Association decided upon a redetermination of the arc of the meridian measured in Peru by La Condamine, because the improved scientific methods and instruments of the present day permit the various elements from which the dimensions of the earth are deduced to be determined with greater accuracy than was possible in the eighteenth century.

The Astronomical Station at Tulcan.

Terminal Monument of the Riobamba Base.

The United States offered to perform the work if France, to which nation it properly belonged, should decline to undertake it. Naturally, however, the government of the French republic felt bound, in honor, to continue to play its historical rôle and sent to Ecuador Capts. Maurain and Liacombe, who explored the Cordilleras from southern Colombia to northern Peru (July to November, 1899).

In their report they showed that this region, which is crossed by two high parallel mountain ranges, is admirably well adapted to the establishment of a meridional chain of triangles, with apices formed by peaks, taken alternately from the two Cordilleras.

Leveling the Tulcan Base.

A Geodetic Monument in the Cordilleras.

Finally, after a report by M. Poincaré and an appropriation by the French parliament, the task was confided to the geographical service of the French army. On December 9, 1900, the vanguard of the expedition, commanded by Capts. Lallemand and Maurain, started for Ecuador, and on June 1, 1901, the main body landed at Guayaquil with twenty tons of scientific apparatus, which had to be carried, mainly on mule-back, over bad roads to the pass of Chimborazo, more than 13,000 feet above sea-level. A month later the little geodetic caravan, by order of Col. Bourgeois, had reassembled at Riobamba. The accompanying photographs give an idea of the life of the detachment on the Andean plateau. A few tents, equipped with rudimentary furniture, scattered about, a portable house for the observation pier and azimuth circle, and some rather primitive kitchen apparatus completed the camp. The work of the expedition was arranged in the following manner: First came the fundamental geodetic and astronomical operations, including the measurement of the base line, the determination of the latitudes of the stations at the center and the ends of the arc, and the measurement of certain differences of longitude, for example, between the principal station at Riobamba and the observatory at Quito. The measurement of angles and bases of verification was reserved for the following years (1902-1905). In addition, in order to obtain the exact altitudes of the stations, it was necessary to run a careful leveling survey from one of them to the sea. The programme of the expedition also included geological studies, the collection of topographical data for a reconnaissance map on a scale of 1 to 200,000, based upon a very exact triangulation, and a study of the native tribes, and the fauna and flora of Ecuador by Dr. Rivet.

The determination of the fundamental base, about 10 kilometers long, at Riobamba, was not made without difficulty. The surveyors arranged along the selected alignment a series of microscopes whose axes coincided exactly with a vertical plane passing through the extremities of the base, and then observed a bar, 4 meters in length, through each pair of microscopes in succession. The bar really consisted of two parallel bars, one of copper and the other of platinum, the difference of expansion of which indicated the surrounding temperature and, consequently, afforded data for the reduction of the observations to zero. The wind and the blinding, sandy dust raised by it compelled the observers (Capts. Perrier and Liacombe) to begin work very early in the morning and to stop at one o'clock in the afternoon. They were able, however, to advance the bar about ninety times each day, thus measuring a length of 360 meters, with an error not exceeding one part in 450,000. The same base was afterward measured twice with the more practical and less cumbrous Jäderin apparatus of metal wire.

Meanwhile, Capt. Maurain set monuments on the peaks near Riobamba, and Col. Bourgeois determined the difference of longitude between Riobamba and Quito by means of telegraphic signals exchanged with M. Gonessiat, of Lyons, who had installed himself in the observatory at Quito. This observatory was built by the government of Ecuador a few years ago but is yet unprovided with observers!

After the completion of these operations the geodetic expedition separated into several divisions, while Col. Bourgeois returned to Paris whither he was recalled by his duties in the geographical service of the French army. In consequence of the rebellion then in progress in Colombia, it became necessary to abandon the northern part of the proposed arc and to seek a new terminal astronomical station and a new base in Ecuador.

Capt. Lallemand made a reconnaissance of the Carchi country, built a temporary observatory near Tulcan and selected the plateau of San Gabriel de Tusa for the location of a base, which he measured four times with the Jäderin wires, with the assistance of Capt. Perrier and Dr. Rivet.

These operations were conducted with difficulty and nearly always in the rain. After bravely acquitting himself of this fatiguing task, Capt. Lallemand finished the construction of all the monuments of the northern section of the arc, while Capts. Maurain and Perrier determined the latitudes of the two end stations, the southern one at Paita, Peru, and the northern one at Tulcan, Ecuador, and thus fixed the length of the arc of the meridian at 5 deg. 53 min. 33 sec.

From this time onward the French officers, divided into three groups, devoted themselves to secondary geodetic observations along the line from Tulcan to Paita, passing through Riobamba and Cuenca. Capt. Perrier occupied the northern stations of Troya and Mirador (3,500 and 3,800 meters above sea level), while Capt. Maurain and M. Gonessiat operated in the center and Capt. Liacombe in the south. Soon afterward all these observers returned to France after having completed the redetermination of the Quito arc. In the course of their five years' labor they were forced to surmount all sorts of obstacles, from the inclemency of the weather to the hostility of the natives, who destroyed the monuments.

The Geodetic Station at La Loura de Quito (Ecuador).

A NEW DETERMINATION OF THE QUITO ARC OF THE MERIDIAN BY THE FRENCH GEODETIC COMMISSION OF ECUADOR.

The following is a typical example of these difficulties. Because of fogs, ten weeks were consumed at Mirador in making observations which could be made in less than a week in France. In this work, therefore, not only were scientific knowledge and experience of the utmost importance, but the participants in the labors of the expedition had to possess patience, perseverance, and courage.

THE NEW TURBINE TORPEDO OF THE UNITED STATES NAVY.

It is always difficult to ascertain just what other navies are doing in torpedo work, because special secrecy is maintained with regard to what is still considered to be one of the deadliest forms of naval warfare; but the new turbine torpedo, known as the Bliss-Leavitt model, which has recently been adopted by the United States government, furnishes the American navy with what is probably the speediest and most effective weapon of the torpedo type in existence.

The readers of the SCIENTIFIC AMERICAN have been made familiar with the Whitehead torpedo of the standard type. The new weapon conforms, in its external appearance and in the leading features of its internal subdivision and method of control, to the Whitehead, but in size, power, speed, range, and accuracy it far surpasses it. The Whitehead of the standard type as used in the United States navy has a speed of 28 knots and a range of about 1,200 yards, and about 22 knots at 2,000 yards. The new torpedo has a range, guaranteed by contract, of 3,500 yards, and its speed is 28 knots at this range and 36 knots at 1,200 yards range. The United States government has been so well satisfied with the new weapon that contracts, amounting to several millions of dollars, have been awarded for the construction of this type of torpedo, which, from this time on, will be the only type used in the navy. Two sizes are being made: one, 18 inches in diameter, which can be fired from the existing 18-inch tubes on our battleships and torpedo boats; and the other, a much larger and more powerful torpedo, 21 inches in diameter. The 18-inch torpedo of the new type has an effective range of 2,000 yards and a speed of 33 knots, and 100 of this type have been contracted for, while of the larger 21-inch, 300 are called for by the contract. Thirty of the 18-inch and two of the 21-inch have been delivered at the torpedo station at Newport, where officers and men are instructed in torpedo work under probable war conditions.

By the courtesy of the Bliss Company our representative was recently given an opportunity to study the construction of the new torpedo in the special department of the works set apart for torpedo work. The new 21-inch type consists essentially of three sections. First, the head containing the explosive; then the central flask in which the compressed air for driving the torpedo is stored; and last, the after body, which contains the turbine for operating the propellers, the immersion chamber for regulating the depth of the torpedo beneath the surface of the water, and the gyroscope gear by which the torpedo is automatically steered and maintained on its proper line of flight.

The head is a beautiful specimen of hammered sheet-metal work. It is formed in two halves, divided longitudinally, the edges of the joints being made with a square, saw-tooth form and brazed together. The war head, which, as distinguished from the practice head, is used only in actual hostilities, is loaded with 132 pounds of gun-cotton, containing 25 per cent of moisture. The gun-cotton is packed in disks through the center of which is a hole that contains a cartridge primer of dry gun-cotton for detonating the charge. The small propeller carried at the extreme point of the torpedo is for preventing premature explosion, which it does by locking the firing pin. When the torpedo enters the water, the revolution of the propellers releases a sleeve, which uncovers the firing pin, putting it in position to strike the detonating primer the instant that the torpedo finds its mark. The central body, or shell of the torpedo, occupies a little more than one-half the total length. It is made of a special forged steel of an elastic limit of at least 90,000 pounds. The rough forging is over 1¼ inch in thickness, and it is bored and turned down in the lathe to a finished thickness of 7-16 of an inch. The "flask," as the central portion, or air chamber, is called, is to the turbine engine of the torpedo what the boiler is to the reciprocating engine of a steamship. It is charged at an initial pressure of 2,225 pounds to the square inch.

The after portion of the torpedo, or the tail, contains in its forward end the wonderful little torpedo engine which drives the propeller. It is of the Curtis compound type, and consists of a central row of fixed blades and two wheels, one 11¼ inches and the other nearly 12 inches in diameter. There are two propellers, adapted to run in opposite directions, one being fixed upon the central shaft, and the other upon an enveloping outer shaft. The turbine runs at a speed of about 10,000 revolutions per minute, which is reduced by suitable gears to a speed of 900 revolutions for the propellers. At this speed the turbine developed about 160 horse-power, the corresponding speed being 40 knots an hour, although the contract speed required by the government is only 36 knots.

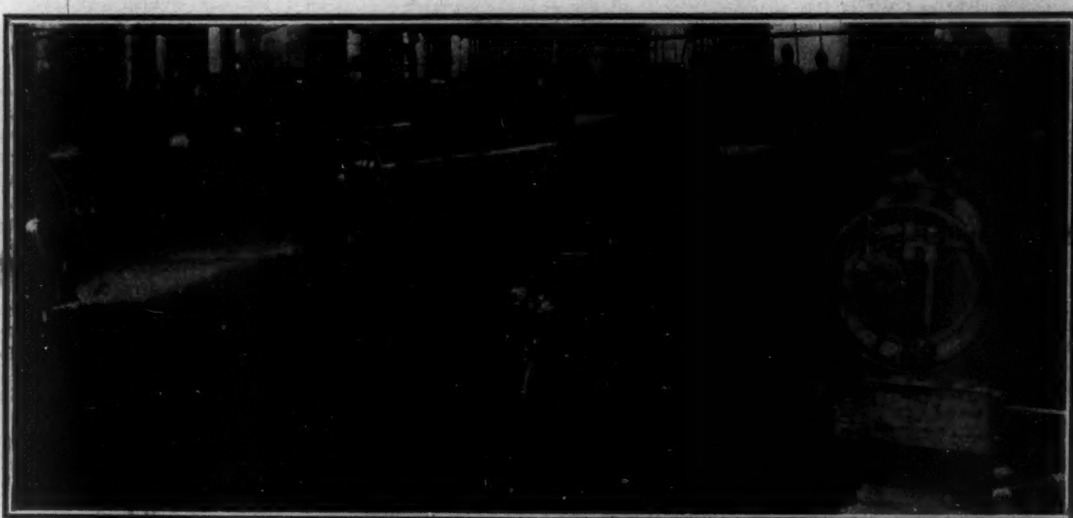
Immediately astern of the compartment containing the turbine is the wonderfully ingenious and delicate apparatus for maintaining the proper depth of immersion and for steering. The regulation of the depth is effected by means of a vertical diaphragm, on one side of which is the water, which is allowed to enter by holes provided in the shell for that purpose, and on the other side a series of coiled springs, the water pressing against the diaphragm on one side, and the springs pressing the diaphragm in the opposite direction on the other side. The springs are adjusted so that their pressure shall exactly equal the pressure of the water at the given depth at which the torpedo is to travel. If the torpedo descends below that depth, the water pressure, overcoming the spring pressure, pushes the diaphragm inwardly. If the torpedo is above the desired depth, the springs overcome the water pressure, and push the diaphragm outwardly. The center of the diaphragm is attached to certain levers and rods, which pass through the tail of the torpedo and act on a pair of horizontal rudders, throwing them up or down, according as the diaphragm is pressed inward or outward, and thus correcting the deviation of the torpedo from the horizontal plane at which it is designed to travel.

Astern of the immersion chamber is located the steering gear. This is a modification of the principle employed in the Obry gear, and depends upon the well-known tendency of a gyroscope to maintain itself in its original plane of rotation. The Obry gear was given its high velocity by means of a coiled spring which was released at the moment of firing. In the Bliss-Leavitt torpedo the spring is dispensed with, and a small reaction turbine is used in its place. This consists of a disk with a series of discharge orifices arranged tangentially to the circumference, which are fed with compressed air. The air rushing from the orifices reacts on the disk, and turns it exactly in the same way as did the pipes on Hero's original turbine of two thousand years ago. If the torpedo tends to deflect to the right or to the left, this little gyroscope turbine maintains its original position, and its angular motion with regard to the torpedo (or to speak more accurately, the angular motion of the torpedo about the gyroscope) serves to actuate a very ingenious mechanism, which turns the vertical rudders to the right or left, and corrects the deviation. The turbo-gyroscope is driven at a speed of 18,000 revolutions per minute.

Of course, the most interesting feature in the building of the new torpedoes is the construction of the wonderfully efficient little turbine engine that drives them. The Bliss Company has designed a very effective

Note the two 4-bladed propellers; the two vertical steering rudders; and the horizontal submergence rudders.

The Tail of the Torpedo.



The small propeller at the head by revolving releases the firing pin as soon as torpedo enters the water. To the right is seen the principal valve group.

A Completed 21-Inch Bliss-Leavitt Torpedo.

A finished warhead is shown on the bed of the lathe. It carries 132 pounds of gun-cotton.

Tail of Torpedo in the Lathe. Finishing the Joint.

THE NEW TURBINE TORPEDO OF THE UNITED STATES NAVY.

machine for cutting the buckets of the turbine wheels. The whole wheel is made out of a single disk of steel, the buckets being integral with the wheel. The machine for cutting the buckets resembles a double-spindle lathe. The work is held in a horizontal position on the tail stock, and two cutters alternately advance toward the rim of the wheel, make a cut of the desired curvature and recede, leaving the wheel free to revolve sufficiently to bring the next bucket into position for another cut. One cutter operates on one wall of the bucket, and the other on the opposite wall. The result is a wheel of perfect form, carrying a highly finished surface. It should be mentioned here that the remarkably high efficiency in speed and range of the new torpedo is due to the use of a superheating process applied to the compressed air. This consists of a flame which is automatically ignited, the instant the torpedo is launched from the tube, and which burns during the entire run. The compressed-air flask contains a burner or pot, the flame of which is fed automatically with alcohol. The flow is so regulated that an even and steady temperature is maintained in the air flask.

During the past few months, the company has been carrying out a series of very exhaustive tests on board the proving steamer "Sarah Thorpe," which is anchored in the secluded waters of Noyak Bay, near Sag Harbor, Long Island. Here each torpedo is tested and brought up to the required standard of efficiency in speed and range before being turned over to the torpedo station at Newport. The Navy Department assigned a lieutenant and several gunners to witness and record the run of each torpedo. The target is a submerged net, 100 feet in length, which is located 1,200 yards from the point of fire. The torpedo breaks through the meshes, and after each shot the net is hauled up, and the exact striking point is located by the tear in the net. The maximum deviation in the range allowed is 15 feet to the right and left of the bull's eye, and 30 inches above and below at five feet of depth. Each torpedo must come within these measurements in three out of five trial runs, in order to be accepted. The average speed of the run is 36 knots, and the time run is about 60¾ seconds for 1,200 yards. The cost of the 18-inch torpedo is about $5,000, and the 21-inch torpedo costs proportionately more.

The Current Supplement.

Jacques Boyer opens the current Supplement, No. 1566, with an interesting article on the truffle industry in France. Excellent illustrations accompany his text. The manufacture of rosin oils is thoroughly discussed by E. Rabaté. Sepia watertone papers, simple to work and cheap, can easily be made by the amateur photographer, if he follows the method outlined in the current Supplement. Notwithstanding the fact that much of the music produced by chimes is rendered with discords, a peal of bells always finds ready listeners. The late George M. Hopkins describes in a painstaking article how an electric chime may be made by any one at a comparatively small expense. Major Ronald Ross, to whom we owe the discovery that mosquitoes are purveyors of malaria, has computed the number of mosquitoes which infest a given area. The method which he pursues is very carefully set forth. Curves in pattern work is the subject of an article which must be of interest to the foundryman. In a very brief and yet comprehensive article Mr. E. F. Chandler tells how to construct an electro-thermostat. The telemobiloscope is the invention of a German scientist. Its purpose is to discover the nearness of one vessel to another at sea during foggy weather, in order to avoid collisions. The invention is described and illustrated.

The Poisons of an Egg.

M. Gustave Loisel, in a paper recently read before the Académie des Sciences, describes some experiments he has been making in regard to the toxicity of certain glands of different animals, vertebrate and invertebrate, and also finds the same result in the case of eggs. He uses in this case eggs from the duck, chicken, and turtle. As to the toxicity of the duck's egg, he makes the following experiments: First, relating to the venous injection of yolks of the eggs which are emulsioned in distilled water. By injecting this emulsion into the veins of rabbits, he finds that seven adult animals are killed by 8 cubic centimeters of the yolk on an average. The animals die in a variable time, from some minutes to two hours, showing at first a contraction of all the members, followed by paralysis. Second, the injections were made with extract from 21 yolks of eggs dried and reduced to powder, extracting with salt water. Using 10 grammes of this powder, treated to 100 cubic centimeters of salt water (1 per cent) then filtered, the solution caused the death of three rabbits when injected into the veins in the proportion of 80 cubic centimeters per kilogramme weight of the animal. Chickens' eggs have about the same effect, but in a somewhat less degree, while turtles' eggs (from the Mauritanian tortoise) have a greater effect, especially for the mature ovules taken directly from the ovaries. Not only does the yolk cause the rabbits to succumb with convulsions and tetanic contractions, but the albumen forming the white of the turtle's egg has an equally powerful effect. Sub-cutaneous injections have the same action. In the case of the yolk, a series of check experiments was made, using an emulsion of oil and salt water, but this had no effect upon the rabbits.

AUTOMATIC WATERING POT.

Our article, with its illustrations, concerning an automatic apparatus for watering plants, recalled to Mr. M. M. Moore, a subscriber, a device which he used upon the suggestion of a "forty-niner."

A few years ago Mr. Moore lived upon a small ranch,

AN AUTOMATIC WATERING POT.

where the only water supply was a small well. In order to have a few plants and flowers, he gathered a number of tin cans—tomato, corn, etc.—cut out the top so that it held by an inch or so, bent it back, so that it could be nailed to a stick, punched a very small hole in the bottom, through which he drew three or four inches of cotton cloth or string, drove the stick near the plant he wished to water, so that the can was eight or ten inches above the ground, filled the can with water, and then drop by drop the water fell upon the ground near the plant all day, sometimes all day and night. The ground soon became saturated, the plant throve, and the quart of water did as much good as an all-day rain.

The accompanying sketch will give an idea of the device.

A New Ozone Apparatus.

The ozone apparatus for medical use which are employed at present do not always work perfectly, as they are more or less influenced by the state of the weather, and besides, the ozone which is produced is often mixed with combinations of gases, nitrogen, ammonia, also phosphorus or metallic oxides, which result from the contact of the ozone and the metallic poles when a too dense charge is produced. To overcome these difficulties, M. Breydel, a Belgian scientist, brings out a new process in which the electric discharge is obtained between plates of large surface which have a special insulating coating. In this way he prevents the spark discharges and the volatilization of the metal at the electrodes. He finds that when above 20 degrees C. the ozone tends to be transformed to oxygen, and thus the amount of ozone depends upon the temperature and also the degrees of the ozonized gas. For this reason he uses poles which are placed in a medium having a somewhat low temperature. The air is well dried before going into the apparatus. A funnel-shaped opening allows of making inhalations, placing the face some eight inches off, or a narrow opening can be used, for local treatment. The ozone can also be passed through liquids, where needed. The new apparatus gives a much larger quantity of ozone than can be obtained by other forms, and it has a great advantage in not being influenced by the weather.

Engineering Notes.

Shipping circles in Great Britain are closely interested in a new experiment in ship construction that is being carried out in a shipbuilding yard on the northeast coast by the inventors of the turret ship, which is now such a popular type of freight vessel. This boat is being constructed without beams and is practically an application of the cantilever principle to shipbuilding. Instead of the beams crossing over the hold, stout stanchions are raised nearly flush with the sides of the vessel and, when these have been brought to a certain height, equally strong diagonal joists are raised from them to the upper decks, thus forming a bracket or cantilever at each side. The stanchions and joists closely follow the lines of a turret ship and thus take up little room. The advantages of this design are that the vessel has a lighter draft in proportion to dead weight, while at the same time it gives greater freedom for shipping long and bulky goods.

Propeller design with the turbine is more difficult than with the reciprocating engine, because the conditions are entirely different from those which have hitherto obtained, and there is so little experience with propellers running at speeds of over 1,000 revolutions a minute in the case of small ships, or at 500 to 750 in the case of large ones. The Cunarders' propellers, it is understood, are to be limited to 180 revolutions per minute. For it must be remarked that in spite of the fact that we now have very clear and logical rules for the design of propellers under existing circumstances logically worked out, nevertheless these rules and formulæ came after the experience rather than before. This matter, however, can undoubtedly be cared for, and when more experience has been gained the design of propellers will be as easy for existing conditions.

Of the various materials used for lagging, magnesia may be considered one of the best and most practicable for use in connection with locomotive service. This composition is of a strict neutrality, and composed of inert mineral matter that will exert no chemical action, corrosive or otherwise, upon any metallic surface with which it may be brought in contact. It will remain unaltered under all conditions of heat and moisture which confront the coverings of locomotive boilers. It has qualities of lightness, firmness, structural strength and porosity, the latter quality especially, upon which depends largely the efficiency as a non-heat-conductor; and this quality being most pronounced in magnesia, it affords the greatest resistance to the transmission of heat. It can also be molded into sectional blocks of any form and size desired for ready application and removal.

As a superintendent of motive power a generation ago, a good mechanic sufficed. He was an old locomotive runner, or a shop foreman promoted, and he was usually called "master mechanic." It was but a short and comparatively easy step from the locomotive, or the shop, to the position of head of the department. In the present day of record-making, of heavy locomotives, large-capacity cars, strenuous operation, large shops and intricate labor problems, such a step is now a hopelessly long one. The sort of man who successfully directed the department twenty-five years ago would find his ability overtaxed to properly manage a single busy roundhouse to-day. A different kind of ability is now required to direct the mechanical department of a single progressive road, and as great roads combine into systems still another new kind of a man will be needed. He must soon be ready, for his work is even now waiting. Is this appreciated? Are the men being prepared?

An interesting new machine has been installed at the yards of the well-known British shipbuilding firm of Messrs. Beardmore & Co., Ltd., for bending ship beams. The general practice of rounding deck beams is by means of powerful hydraulic pressure applied section by section to the member for which the camber is required. With this new appliance, however, the beams are bent and completed with the greatest rapidity notwithstanding their dimensions or caliber. The machine consists essentially of rollers which are set vertically and can be made to suit any degree of camber or curvature. These rollers operate upon the steel beam just as it arrives from the steel-works. It passes quickly through the machine, and is then ready for working into the hull of the ship for which it is intended, the beam being quite completed when it leaves the bender. Any type of beam can be handled, from the heaviest to the lightest, and angle or T-shape, with equal facility. The apparatus is being utilized for cambering the T-beams, 12 inches deep, required for the British battleship "Agamemnon" now in course of construction by this firm.

Correspondence.

A Word from an Old Reader.

To the Editor of the Scientific American:

After an acquaintance with the Scientific American of over half a century, I feel like expressing my indebtedness to it for its many excellent features. I read it weekly from the first page to the last, including the advertisements, and am always struck with its versatility and grasp of the subjects it handles. The editorial page is remarkable for its accurate forecasts, and orthodox mechanical analyses when commenting upon engineering matters. I am apt to be a sharp critic in this direction, for, having had more or less to do in this line for over sixty years, I have come to insist upon exact expressions upon such subjects, instead of vague surmises timidly put forth. If I had a young son I should give him the Scientific American as a safe guide in physics in general; the illustrations are germane to the subjects and very much assist the reader to see all sides of the topic discussed. After reading your paper continuously I do not think any young man would be apt to say, when asked what his lecturer talked about in the morning: "It was the sub-acetate of something—but I forget what." If a youth cannot learn much that will instruct him from the Scientific American he must be obtuse. I will close by wishing more power to you, and many years of usefulness in your especial field.

Egbert P. Watson.

Elizabeth, N. J., December 13, 1905.

Lubricating the Underwater Surface of Ships.

To the Editor of the Scientific American:

A correspondent in your issue of December 23 puts forth what seems to be an excellent idea with reference to lubricating the underwater surface of ships by air bubbles driven down a tube by means of a force pump.

It strikes me, however, that the air pump would not be needed. Would not a series of tubes passing down the bow, opening just above the water line in front, and at various points under the ship, serve the same purpose? Of course, when the ship was at rest, the water would fill the tubes to the same level as outside. But when the vessel was in rapid motion, the motion would create a suction that would empty the bottom of the tubes, and the vacuum thus produced would be filled with air that would rush in at the top of the tubes. This air in its turn would instantly be drawn out by the suction and distributed under the vessel, and thus a continuous air cushion would be formed upon which the vessel would glide forward as if floating in air, with far less resistance than would be caused by the friction of the water. At least, it seems so to me, and that your correspondent is right.

Then, if over one or more of these tubes was placed a can of kerosene with a small perforation at the bottom, the dripping of the oil would be drawn down the tube and prevent the formation of barnacles, as your correspondent suggests, and still farther lessen the friction by the glutinous coating it would produce.

E. P. Foster.

Cincinnati, Ohio, December 25, 1905.

Electric Propulsion for Inland Waterways.

To the Editor of the Scientific American:

I have not seen the suggestion from any quarter as to the use of electricity generated by the turbo-electric or gas-electric systems for the propulsion of craft on our inland waterways. To my mind this is a field rich in possibilities for future development.

There are a few advantages arising from this use of power:

1. More energy from a given amount of coal than by old methods, which saving admits of greater speed to the boat, or a greater freight-carrying capacity.

2. There would also be certain advantages in the arrangement of the boat's machinery. The energy being conveyed to a motor directly connected to the shaft of the propeller wheel by wire eliminates friction, thereby saving power, and makes possible a greater latitude in the application of the power. Two or more side wheels on each side, or both stern and side wheels simultaneously, could be readily used. This would have a beneficial effect in permitting a reduction of the draft without a corresponding loss of power, always an advantage on river craft. On towboats power thus generated could be conveyed by wire to barges having propeller wheels, arranged alongside of the tow, giving great propulsive effect as well as adding much to the manageability of the tow. These motor barges could have wheels on one or both sides at will. This suggestion may have value also as regards ocean towing, for from one engine room power might be conveyed to several barges trailing behind the towing vessel.

3. Another distinct advantage of the use of electric propulsion would be in the centralization of responsibility in maneuvering the boat. The pilot would have absolute control of the power independently of the engine room, a very apparent advantage. Wheels could be started, backed, or stopped with no more effort than is now required to ring up the engine room, a point of vast importance in the management of a boat on a river.

4. Lastly, passenger boats could be so constructed that they could be backed with great ease. By the simple movement of a lever the control of the boat could be shifted to a pilot house in the stern, and a landing could be made without the delay of "rounding to" which is so annoying an incident of a journey *down* a river.

J. Logan Irvin.

Americus, Ga., December 9, 1905.

The Mosquito Theory of Yellow Fever.

To the Editor of the Scientific American:

The question recently propounded through the Scientific American by William F. Wilson, M. D., impressed me as quite apropos to the subject of yellow fever, especially this one: "Where is the inceptive—in the man or the insect? Is there not a commencement?" The proposition that the mosquito is the sole cause has always appeared to me as very much unfounded. They say a mosquito, before it can transmit the germ, must first bite an infected man. Now, whence comes the first infected man? That is, the very first, and no guessing allowed. They have demonstrated that mosquitoes do transmit the germ—but to the conclusion that nothing else does would seem a very long, foolish jump.

They may say that bogs and filth are not unhealthy; they do say this of bogs. It is simply an absurd subterfuge to uphold the very picturesque theory that the mosquito is the sole cause. They even hold that impure water conveys no malarial germs, but admit it might convey typhoid. This looks technical. They have declared war on the mosquito, and it seems like they are sinking all other considerations and defenses before it. S'death to the mosquito! Drink impure water! Eat impure food! Neglect sanitation! There is no Devil but Mosquito!

As an evidence of the unhealthfulness of low lands, take notice of persons living on such (even in river towns and cities). They are never so healthy as those living on higher ground. And this holds true in the winter, when the mosquitoes are dead. Do they continue their wickedness after death? Will the learned doctors never let up on the *Anopheles* and *Stegomyia?*

Well, then, what is your theory? It is this: The bogs and the filth and the mosquito are three causes; there may be others. Dr. Wilson suggested another idea: "If filth is not a factor, why the preliminary cleaning up?" etc. The fact is, there are doctors so imbued with the beauty (?) of the "mosquito theory," they argue that filth is no factor. Doubtless, in New Orleans, there were some of these, of high standing, of like persuasion. Consequently, there was little, if any, cleaning up, with the natural result of a severe scourge of yellow fever. This will happen again and again so long as the ridiculous idea of the mosquito being the sole cause of yellow fever is not uprooted.

L. P. Palmer.

Paducah, Ky., November 30, 1905.

Build the Canal at Sea Level.

To the Editor of the Scientific American:

I have been a constant reader of the Scientific American for many years, and have been interested in no series of articles which you have published more than those on an isthmian canal. The pains you took to obtain accurate information regarding the two projected routes, Nicaragua and Panama, and the clearness and perseverance you exercised in placing these facts before the public, were admirable, and should be acknowledged through all coming time by a grateful country.

I have been further profoundly interested in the late discussion about a sea-level canal. There is no question in my mind of the ultimate necessity of the sea-level type for that famous waterway, nor is there any question concerning the wisdom of its present adoption. The judgment of the foreign members of the expert commission ought to settle that in the public mind, as the American members could not but be, though unconsciously, influenced by the fear that our people would not sanction the added cost immediately; and this I say with all due belief in their professional sense of honor. The present construction of a lock canal, and a later change to sea level, entails an excessive cost in time, money, and annoyance incidental to the change. My family once lived in our house while it was being raised and a new story built underneath us, and you don't catch me submitting to any similar ordeal again or advocating anyone else doing so, not even the directors of a public canal. We have got to pay the bills for a sea-level canal some day, and by far the cheapest and best way is to incur those bills now.

Where shall we get the necessary funds? We are bordering on bankrupt expenditure in our feverish desire to have the biggest navy in the world, and can wisely and should determinedly retrench along this line. The building of ships whose known effective service will be for but five years, and the extreme limit of whose life is but twenty years, should be wisely limited. Money so saved will go far toward the extra cost of the canal. The country's prosperity will do the rest. A well-built canal, properly cared for, will last for all time. The devotion which the predominating elements of this nation have shown, are showing, and are likely to show, in advancing the interest of mankind in general is worth more for our protection and peace than all the navies of the world combined. The same may be said of every nation which exalts itself by intellectual attention to truth of all kinds. For the latest proof of this doctrine recall the battle of the Sea of Japan. Houses are needed to live in, but their chimneys don't need to be tall enough to knock down the stars. Navies are needed for police duty, and may do some service as scarecrows, but it is not necessary that, bow to stern, they should form a cordon entirely around our coast. To be sure, we need the canal at the earliest practical moment, but we need to exercise patience quite as much, and we need thoroughness and business prudence even more. Let us cultivate these virtues.

George B. Kilbon.

Springfield, Mass., November 21, 1905.

Some Interesting Experiments with Acid and a Coiled Spring.

To the Editor of the Scientific American:

A number of years ago I had occasion to do some work on a motor, the motive power being derived from a coiled spring, which in this case was coiled in a barrel. It was run down, and the larger part was expanded tightly against the barrel. I used common muriatic acid to clean the motor, applying it with a small piece of cloth. While cleaning the barrel, an ominous clicking attracted my attention, seeming to come from the spring inside. Investigation showed that the acid, which I had taken no special precaution to keep from the spring, trickled through it more or less, causing it to crack and snap, in probably a hundred pieces, in lengths from half an inch up. I saw at once the spring was ruined, and as it was quite interesting to me, I, after a while spent in watching the peculiar demonstration and it had got quieted down a little, applied a little more acid, when it would at once start up again. This spring was two inches wide, and quite heavy. The only part that was affected, however, was the outer part, which pressed with all its strength against itself, and against the barrel. A few inner convolutions were not at all affected, there not being strain enough on them, probably.

This episode proving so interesting, I did a little experimenting. Snipping some pieces from an old clock spring, then after bending it between thumb and finger to get a good strain on it, I immersed the bent portion in the acid. Simple contact with the acid was sufficient to cause the piece of spring to snap violently, scattering the acid in all directions. Taking a piece of a smaller spring, about a quarter of an inch wide and two inches long, and after bending it between thumb and finger, to the shape of the letter U, simply wetting the *outside* with the acid, at the bend only, would cause it to snap at once. By holding a piece in the acid a few seconds, and then attempting to bend it, the same result was obtained.

Putting a piece under the same tension by bending as before, then applying the acid to the *inside* of the bend, brought no disastrous results. The acid was applied with a match, care being taken not to allow it to run over the edges, thus wetting the outside.

A piece which was twisted to quite an extent, then held in the acid, showed no ill effects. Not enough strain on it, probably. In fact, pieces of different springs were not all alike as regards their sensitiveness. This I accounted for by assuming they were not of the same temper, or the same degree of hardness. The treatment had no effect on annealed springs.

Perhaps these experiments may help settle the coiled spring question as to what becomes of the energy, etc. My answer would be that the energy is there all right, and when the attempt is made to dissolve the spring or eat it up with acid it would make itself manifest.

These experiments were made about forty years ago. Since that time I have seen the question, What becomes of a coiled spring's energy? asked many times, I think a few times in the Scientific American in years gone by. Perhaps here is a good place to say that we have had the Scientific American in the family since the early fifties.

Charles D. Mowry.

Middletown, Conn., December 23, 1905.

A test of the McLean automatic gun was made from the deck of the United States revenue cutter "Mohawk," some 30 miles off Sandy Hook. The gun is a one-pounder. From 75 to 100 rounds were fired very successfully, it is reported, and the distances ranged from 1,000 yards to three miles. In the trial the gun, weighing but 540 pounds, was mounted on a tripod. There was no apparent recoil to the gun, it is said, when fired at the rate of 100 shots a minute.

THE CAVITÉ DRYDOCK.

BY DAY ALLEN WILLEY.

The tests of the floating drydock designed by the United States government for service in the Philippines have proved so successful, that the craft is now on its way to Cavité.

Since its completion it has been lying in Chesapeake Bay off Solomon's Island. Here an opportunity has been given to thoroughly demonstrate its capacity for docking not only vessels, but to dock itself. In each trial the drydock has performed service up to the requirements of the specifications. The vessels selected for the tests were the new cruiser "Colorado" and the battleship "Iowa." The reason for docking a ship of each class was to determine the strength of the dock by different distributions of weight upon it. It may be needless to say that the "Colorado" is considerably longer than any of the battleship class, being more than 500 feet.

Consequently, the weight of the "Colorado," though much more, was distributed over such a greater length of the dock that the strain upon it as indicated by the deflection was considerably less than when the battleship was lifted from the water; but as already stated, the deflection was no more than the calculations of the engineers—in fact, was not as great as that for which allowance had been made.

At the time she was placed in the dock the "Colorado" represented 13,300 tons displacement. In allowing the ship to enter the dock the latter was sunk to a draft of 29 feet over the keel blocks. The cruiser was then placed in position, the pumping machinery set in motion, and the dock lifted until a freeboard was provided of 2½ feet. In this position the ship was carried during a period of twenty-four hours, measurements being taken from time to time to ascertain the exact effect of the weight upon the dock structure. When the greatest freeboard had been attained, the total deflection upon the 500 feet of keel line of the dock supporting the vessel was found to be but one-quarter of an inch. At the end of twenty-four hours the total deflection was 1 1-16 inches. But after the ship had left the dock, the keel line straightened until no deflection was apparent.

While the "Iowa" represented but 11,600 tons displacement, the docking of this ship was probably a more severe test, not only by reason of the weight resting upon merely a portion of the dock, but on account of the length of time the ship was held in position and the height of the freeboard. The latter was no less than 4½ feet, while the battleship remained in the dock forty-eight hours. During this trial the total deflection of the keel line at the time when the "Iowa" had attained the greatest freeboard was two inches. At the end of twenty-four hours the deflection had increased to four inches, but strange to say at the end of forty-eight hours the dock had actually straightened until the deflection was but 3⅝ inches. After the ship had again entered the water, an examination of the keel line showed a "hog" or bulge measuring about an inch, which in twelve hours had changed to the sag of about a half inch.

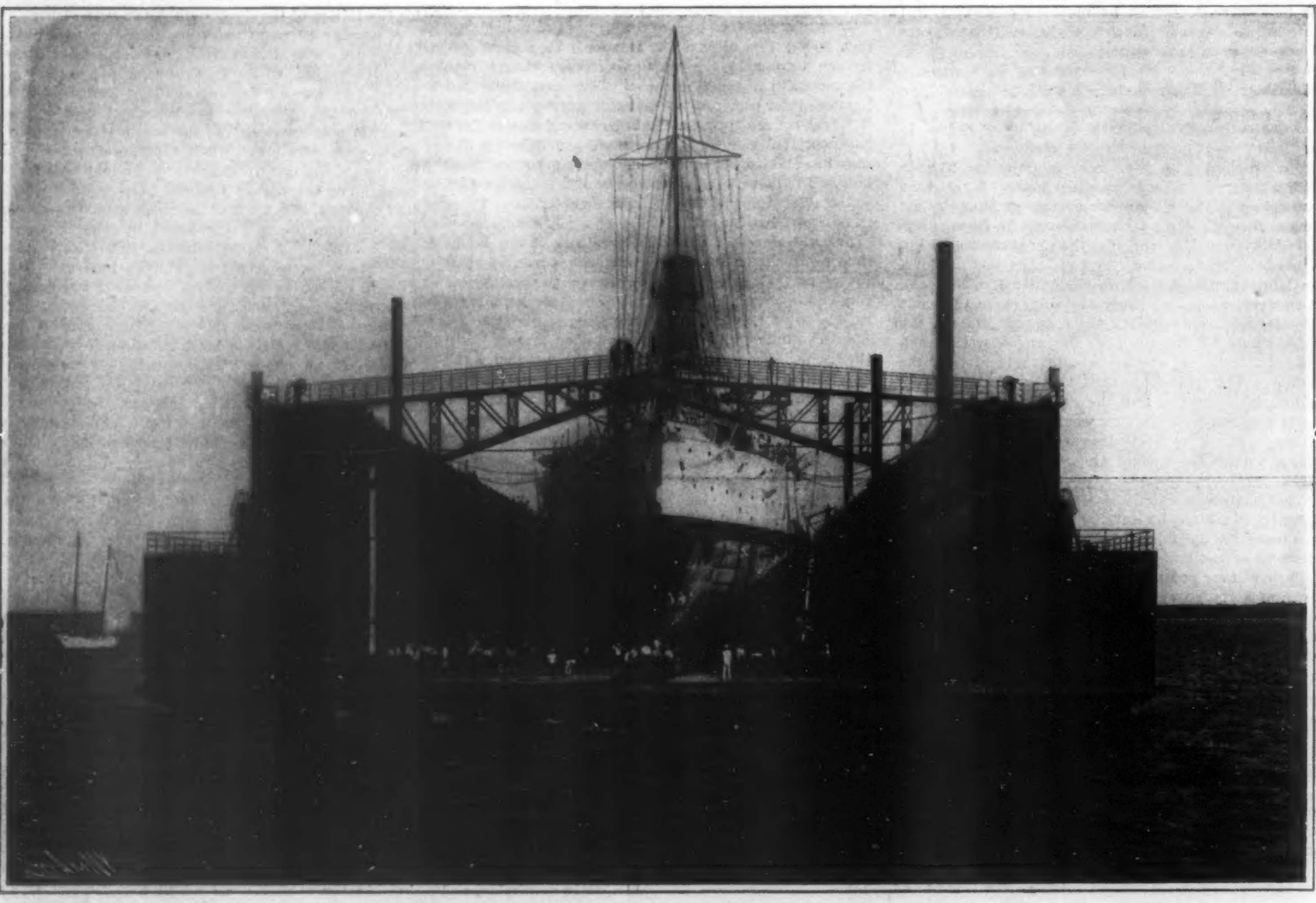
The most interesting of the tests by far, however, was the docking of the center section of the structure by utilizing the pontoons at either end. To clearly explain how this remarkable engineering feat was made practicable, a brief explanation of the adjustment of the pontoons should be given. As readers of the Scientific American are aware, the main pontoon is no less than 316 feet over all, each end pontoon being 170 feet over all. The ends of the main pontoon overhang the smaller ones, each of the latter having an outside independent side wall high enough to allow it to be sunk and hauled under the center structure, literally fitting around the center on the same principle as the familiar collapse or telescopic box. When the three sections of the dock are connected and in service, the connecting elements consist of 2-inch bolts arranged in series, each series consisting of 44. These bolts are adjusted so that they can be readily removed, but as the tests demonstrated, rigidly hold the three sections of the structure.

To perform the first operation of self-docking, all portions of the center pontoon under water were required to be raised to a height of not less than five feet above the surface—thus allowing sufficient space to scrape and paint the bottom when deemed necessary. In raising the center pontoon, the connecting bolts were first removed between it and the ends. The latter were then submerged to such a depth as to allow twelve inches of clear space between their ship deck and the bottom of the center pontoon. This permitted them to be drawn under it and "centered." As the main section had been pumped out before the ends were placed on it, the only work remaining was to remove the water in the end compartments to the proper draft, thus lifting the weight.

The dock was also designed not only to lift the center pontoon from the water, but the ends. In this operation the movements were practically reversed. The connecting bolts being removed, the end pontoons were first hauled clear of the center. The compartments of the latter were filled until it had sunk to the proper depth. The end pontoons were then turned so that the direction of the length of each was perpendicular to the axis, which allowed them to be floated over the main portion and centered on keel blocking, the plan followed being similar to that in the docking of a vessel. The center pontoon was then pumped out, and the ends lifted to the proper freeboard without difficulty.

In docking the cruiser the entire structure was sunk to the maximum depth in one hour and thirty-six minutes, but pumped out in less than this period, the exact time being one hour and two minutes. Considering the size of the "Colorado" and the magnitude of the work involved, the time required was remarkably short, as only two hours and sixteen minutes elapsed from the time the ship was landed on the blocks until the keel was raised completely out of water. The "Iowa" was lifted above the surface of the water in one hour and thirty-seven minutes, and to the freeboard of 4½ feet in two hours and forty-two minutes, but during this operation one of the three pumping engines in the main pontoon ceased working for forty-two minutes, so that with the entire pumping capacity of the dock in operation, the time would have been somewhat shorter. In the self-docking tests each pontoon was sunk, hauled out, pumped to the proper draft, and connections made in twelve hours. In brief, the decision of the board of supervising engineers was that the dock is of sufficient strength and capacity to dock a ship of 20,000 tons displacement.

The arrangements for towing this great structure are of no little interest, on account of the length of the voyage and the weight and dimensions of the dock. While the framework, plating, and machinery contained represent a weight of nearly 11,000 tons, its height above the water, its unwieldy proportions, as well as draft make it far more difficult to tow in a seaway than an ordinary craft. In fact, it is a question if a raft cannot be guided with less difficulty. The towing fleet selected is composed of three United States colliers. The largest of these is the "Glacier," a ship of 7,000 tons displacement and having engines of 5,000 horse-power. The "Glacier" will be assisted by the "Caesar," of 5,016 tons displacement, having engines of 1,500 horse-power, and the "Brutus," of 6,000 tons and 1,250 horse-power. Consequently, the entire towing power will aggregate nearly 8,000 horse-power. The smaller craft, however, will be used not only for direct towing, but for steadying the dock in rough weather. In case of a storm, the suggestion



Water Completely Pumped Out of the Dock and the Vessel Raised.

THE CAVITÉ DRYDOCK.

has been made that it can be sunk to its maximum depth, thus exposing but a small portion of its side walls to the sea. The engineers, however, are of the opinion that its construction is sufficiently heavy to withstand a very severe strain.

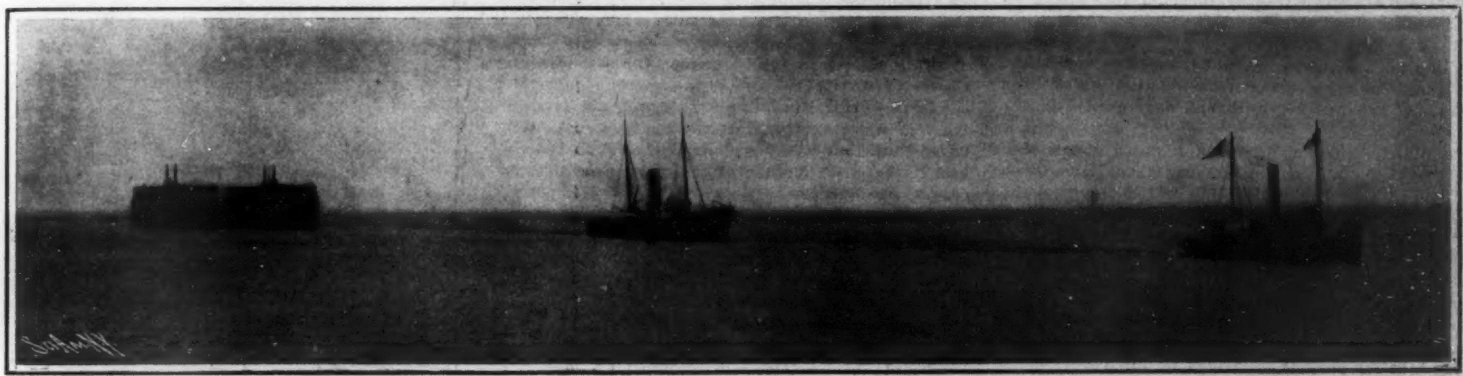
The route selected is by way of the Suez Canal. While this is somewhat shorter than around the Cape of Good Hope, it is calculated that the dock will cover nearly 11,000 miles before reaching its destination. By the ordinary sailing route the distance is 11,650 miles, going by way of the Straits of Gibraltar, the Mediterranean Sea, the Canal, the Indian Ocean, the Straits of Malacca and the China Sea, although it may be necessary to take the dock to the south of Sumatra Island and not through the Straits. The question of towing through the Suez Canal is no small problem, for the minimum width which will accommodate the structure is 200 feet, the width of the dock itself being 134 feet. Therefore but 66 feet leeway is allowed to work it through the narrowest part of the canal. The Navy Department calculates that the fleet can move at the rate of about 100 miles per day, allowing about four months for the entire voyage. In towing, the cables used will be attached to machines which automatically pay out and haul in the connecting lines, thus easing off the great strain, which would probably break the cables in a heavy sea.

Interesting Facts Concerning the Carpet Industry of Persia.

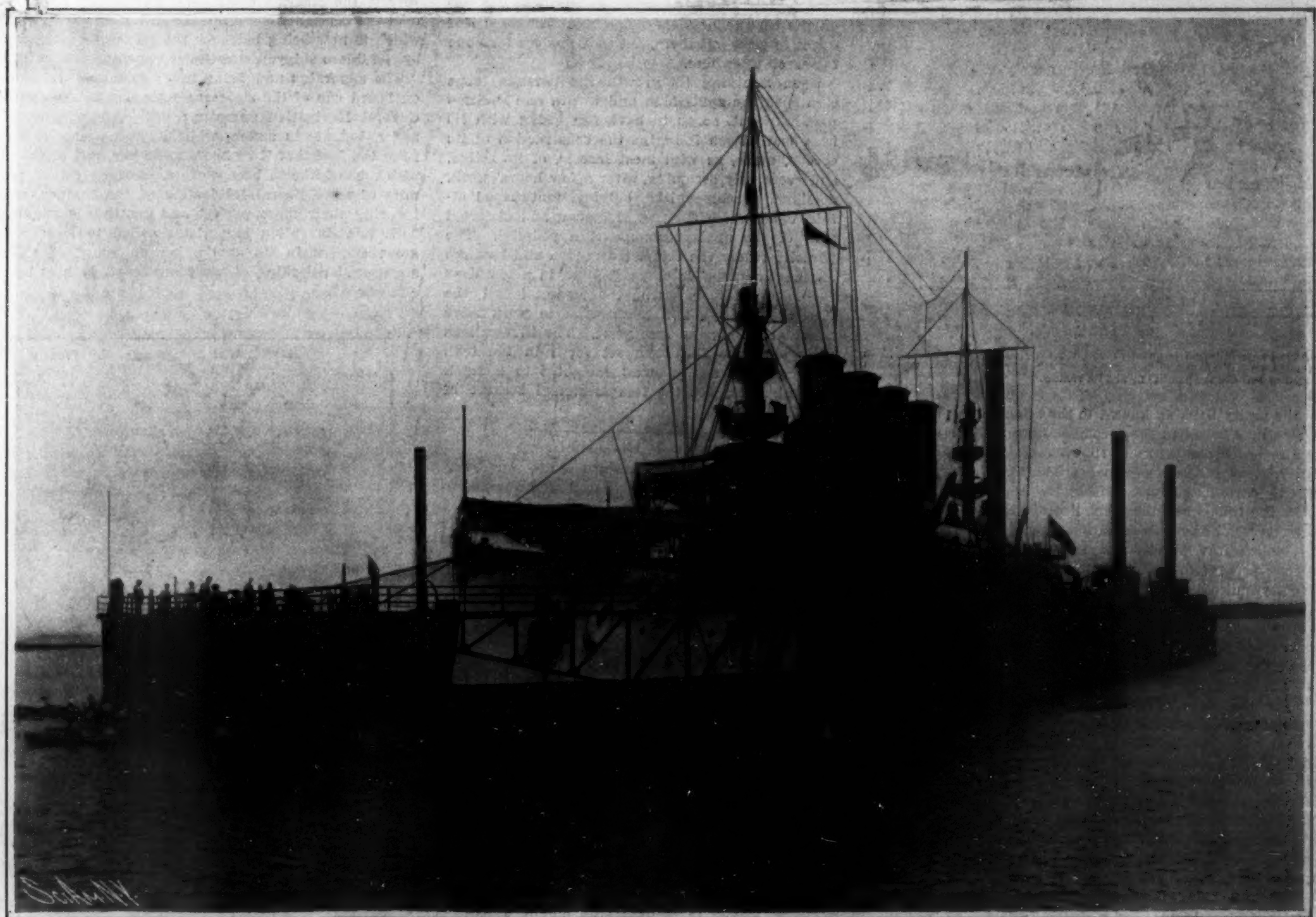
Some interesting facts concerning the carpet industry of Persia are contained in the latest report of the British consul general for that country. Carpet manufacturing at Khorassan and the majority of the other manufacturing centers is divided into two classes—town woven and nomad woven. In Meshed itself there are 400 frames; in the Turshiz district there are over 50 frames, and further south near Durukah, in the Kain district, over 450 looms were found working. None of these carpets can vie with the exquisite products of Kerman, although the quality and color are improving. There are from 2,000 to 3,000 looms in which nomad carpets are woven. These Baluch carpets are mainly worked in dark shades of red and blue. An interesting custom prevails among the nomad tribes by which a girl, before becoming eligible for marriage, has to prove her skill by weaving two very fine rugs or saddle-bags. It is this class of work which is particularly prized in Europe and America. In 1903-4 a law was re-enacted by the Persian government by which the customs department was instructed to seize and burn all carpets in the manufacture of which aniline dyes were used. A total cessation of exports resulted, and owing to the hardships inflicted by this decree manufacturers were granted a certain period of grace in which to dispose of their stocks of carpets condemned by this measure.

Why Do We Smell?

Is the sense of smell excited by gases or particles? According to Dr. John Aitken, F. R. S., the eminent English specialist, who has devoted considerable time and study to this problem, gas is the fundamental basis of the sense of smell. In experiments he first investigated musk, of which it is possible to detect by smell, according to Berthelot, 0.000,000,000,000,000,01 gramme. Dr. Aitken carried out his researches upon the cloudy condensation basis, in which, if odors are attributable to particles, the latter form nuclei of cloudy condensation in supersaturated air, and thus make their presence visible. In the case of musk no such nuclei were detected, proving conclusively that musk does not give off solid particles, but evaporates as a gas or vapor, and that it is gaseous particles from the musk that act on the sense of smell. Of twenty-three other odorous substances, not one gave its perfume in solid particles, nothing but gases or vapors escaping from them. Dr. Aitken points out that our nostrils appear to substantiate this theory. The perfume of snuff, for instance, is a soft, velvety sensation, while the effect of the solid is sharp and biting, more allied to pain than pleasure.



Towing the Algiers Dock to Its Station on the Mississippi, Showing How the Cavité Dock Will be Taken to the Philippines.



An Armored Cruiser Ready to be Lifted Out of Water.

THE CAVITÉ DRYDOCK.

A LITTLE FRIEND OF THE ROSE.*

BY S. FRANK AARON.

The flower-loving insects are all friends in need; but the unhoneyed flowers also have their insect friends, not agents of fertilization only, but protectors and champions that fight the battles of those that must depend on the flower stems and leaves and buds to survive. But though the flowers are voiceless, they tell us with none the less eloquence what their enemies are and how they suffer by them. Ask the rose. The withered, skeletoned leaves proclaim the enmity of the saw-fly slug; eaten leaves and others folded over tell of the larvæ of the golden-winged tortricid moth; while cankerous, eaten buds and flowers denounce the rose bug, the aphides, that crowd the green stems and leaves of the newer growth and swarm all over the tender buds.

Annihilate the aphides upon a dozen stems of a thrifty bush and keep others off; then let a dozen others go full of the lice, and watch results. The number and the beauty of the blossoms will be the answer. Now, Nature generally makes a wise effort to strike a proper balance, and though we have heard this denied concerning the potato beetle, yet it is true, more or less. Thus she has furnished several antidotes for the aphis; if she did not, the little pests would become a nuisance indeed, past all calculation. This salutary purpose is effected by the several larvæ of the syrphus fly, the lace-winged fly, the ladybug and a number of very small Hymenopterous parasites. Of these latter the most interesting and the most common

LITTLE FRIENDS OF THE ROSE AT WORK AMONG A HERD OF PLANT LICE.

Any one carefully and frequently inspecting the rose bushes and the aphides gathered on the green and tender new growth may see enacted the small tragedies between the parasite fly and its victims.

is the pretty little fly known to the scientists as Praon, which may be called the cocoon-making parasite of the aphis. Any one with sharp eyes may discover this little friend of the rose at work, and may follow, with a little care, its complete life history.

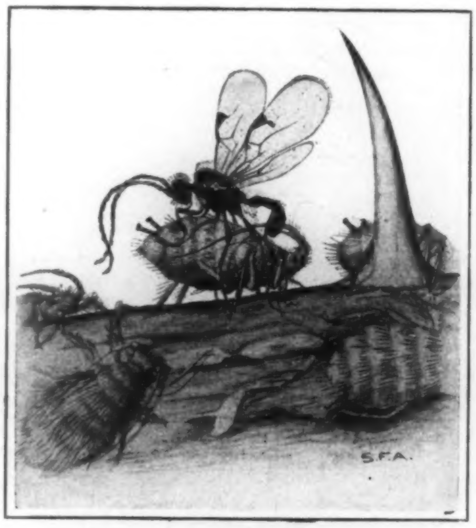
At the time when the plant lice are thickest a small insect resembling a miniature wasp, or an ichneumon fly, which it really is, may be seen making its way among the fat aphides, moving leisurely and with a dignity quite beyond its size, for it usually is not longer than an eighth of an inch. It approaches one of the larger aphides and touches it with its antennæ as a means of certain identification, scent far outranking sight in such matters among insects. If this were an ant the aphis would respond with a liberal supply of the coveted honeydew, but knowing friends from foes it now slings its body from side to side, quite violently indeed for such a lethargic creature, and the little fly is pushed aside. Not liking this it moves on to another or smaller aphid with a less vigorous movement, or pausing a moment attacks the same aphis again, with perhaps better results. Choosing its position deliberately and carefully, with its slender, stiltlike legs lifting it high, it widely straddles its victim, its fore legs often resting on the aphid's back, its slender body and long antennæ much jostled by the agitated plant louse. But now the fly is not to be dislodged. Its keen, swordlike ovipositor protrudes from its sheath, and in a moment is thrust deep into the back of the plant louse, and is held for just another moment, until an egg, so tiny as to pass through the slender organ, is deposited into the very interior anatomy of the rose pest. Then withdrawing, the fly straddles off and proceeds at once to convert another aphis into an incubator, and so on, until no doubt the egg supply, perhaps fifty or more, becomes exhausted.

Of course the aphis so treated does not die at once, else Nature's plan would miscarry. It lives and goes on feeding and maintaining the same stiff and seemingly contented attitude for a little while. Meantime the egg hatches a minute, white, maggot-like larva, and this at once begins feeding on the soft muscular tissues of its host. Some little time is required for the larva to complete its growth—five or six days during very warm weather, longer when it is cool. With an instinct that has ever been a marvel to the naturalist the little larva does not touch the digestive organs, the vascular system or the more important nerves for a period, thus permitting the aphis to live and feed until the appetite and growth of the parasite warrant it to eat all before it. Then the aphies dies, of course, and rapidly becomes only an outer skin, with head and legs attached.

For some strange reason the aphis, not long before dying, forsakes its place among its fellows. As if ostracized for its condition, although its disease is hardly catching, it crawls away to one of the larger leaves, fastens upon it in exile and thus remains. It is obvious that this benefits the parasite; the aphis here is far less apt to be found and attacked by numerous other enemies that would endanger the life of its guest. But what can influence it? It departs from its habit, for it is altogether social and non-migratory. It removes to a less desirable pasture ground. Normally, if dislodged from the stem and falling on the leaves it crawls back as fast as its indolent legs permit to the stem again.

The parasite is alone benefited, but it is out of the world, so to speak; it can not get at its host's locomotory appendages; it is a legless, eyeless creature that at best would make a poor guide if it should get out and take the lead. But the little thing, as unintelligent as it looks, maggot-like, has perhaps a mind of its own, as we have seen. The habit is almost invariable; the victims crawl from their usual places and position themselves on the leaves. Out of seventy-one parasitized plant lice I found two on the stem and one on the tip end of a thorn, as if it thought a leaf ought to grow out there, but that was too far gone to search elsewhere.

Upon attaining its growth the parasite larva cuts open the aphis skin underneath and squirms part way out, so as to have full swing with its head end. Then it begins the construction of its cocoon, made, as with most insects, of its saliva, and eventually becoming, after a few hours' work, a silken, parchment-like, bulging, tent-shaped affair, upon which the now shrunken and distorted skin of the aphis rests as on a pedestal. The parasite enters the completed cocoon and becomes an inactive pupa or chrysalis, and in a few days thereafter, if it is warm, the perfect insect, the tiny fly, emerges and takes wing to work more mischief among the rose pests. The illustrations fully elucidate the facts set forth in the text. They present a wonderful insight into a small natural force, not the less masterful because of its mimic scale.



MINIATURE PIG STICKING, AS SEEN THROUGH MAGNIFYING GLASS.

The fly of the rose aphis parasite stinging and laying its egg in the body of a rose aphis. The plump little plant lice look like hybrids between a verdant goat and a green pig and they get about much like overfat swine. Their inactivity permits them to be readily attacked, and their only attempt at defense is in wagging their bodies from side to side, which sometimes for a moment disconcerts the parasite fly.

* From American Homes and Gardens.

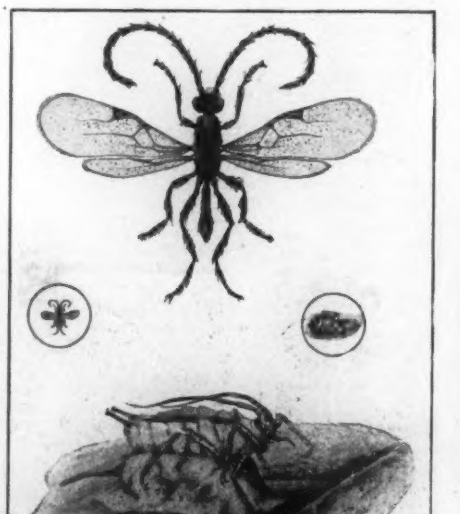
Two Valuable Inventions.

Two apparently valuable innovations are now being put on the market in Italy, the first of which seems to be highly suitable for use on board submarines. The Italian Health Society (Societa d'Igiene Italiana) is now exhibiting at the offices of the Federation of the Technical and Scientific Societies an apparatus which has just been patented in Italy, France, and Germany, and to which the inventor (Signor Bertini) has given the diverting name of the "Bertini noseroscope," or bad air detective.

Besides being a veritable indicator of the presence of foul and noxious air and vapors in general, this apparatus is likewise intended to prevent the occurrence of accidents due to the presence of dangerous and inflammable gases which might, during the night or unperceived at daytime, escape into rooms and compartments from stoves, cooking ranges, pipes, and the like, or accumulate in any other way due to stoppage of normal draft. When the pressure in the inner chamber of a stove, range, etc., is less than that of the external atmosphere, the gas or vapor cannot escape because a good draft is induced, whereby the combustion of the gases or their removal *via* the proper channels of escape is assured. To obtain a perfect draft and proper combustion, so as to prevent all noxious effluvia and gases from escaping into inclosed spaces and thus causing danger to health and life, it is thus essential that there should always be a slight depression in the pressure prevailing in the combustion chamber. The duty of the noseroscope is to call attention at once to any stoppage or abnormality in this inner depression, an alarm bell being set ringing, which will not stop till the proper pressure has been restored.

The second invention is also one of special interest to all concerned in matters naval. At the oil and grease works of Messrs. E. Follzer & Cia., at Rivarolo (Liguria, Italy), trials are now being made with a new apparatus for the re-utilization of the oils used for lubricating marine engines; the inventors are two Italian engineers, Signori G. B. Bibolini and G. Baulini. The experiments are being carried out under the auspices of several well-known technical men, including engineers Varella and Jorge Howard, both members of the Mexican commission appointed to superintend the construction of the big transport "Progreso," which is now being built for the Mexican government by the Odero shipyards at Sestri Ponente.

The apparatus now being tested is intended for use on board one of the steamers belonging to the Italian General Navigation Company; it is extremely simple and automatic in action, while its value may be seen from the fact that it recuperates 70 per cent of the oil which has hitherto been wasted. Despite this it permits of more liberal lubrication of the engines, thus insuring their more perfect and continuous running. This new invention is perhaps called to meet with great success in its application on board of ships, steamers, battleships, *et hoc genus omne*, both at home and abroad.



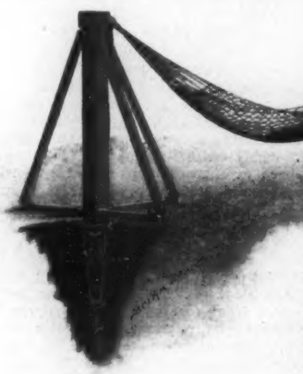
THE PARASITE OF THE ROSE APHIS, MUCH MAGNIFIED

The upper figure is the fly as seen from above; the colors, black, rufous red and yellow, have almost a metallic luster, and the delicate, transparent wings reflect a beautiful iridescence. The lower figure is the cocoon of the parasite beneath the dead, dried and distorted shell of a plant louse, the insides of which have been eaten by the parasite larva while attaining its growth, after which it makes the cocoon. The little figures in the circles indicate the natural size.

Patent Department

SUPPORT FOR HAMMOCKS.

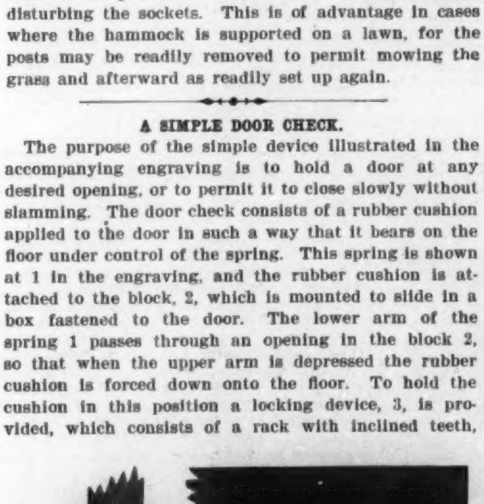
The hanging of a hammock is often quite a problem, because of the lack of suitable supports at the desired location. Only occasionally can two trees be found spaced apart the required distance for the hammock. Posts are sometimes sunk into the ground to serve as supports, but the constant swinging of the hammock is apt to work them loose in time. In the accompanying engraving we illustrate a new hammock support patented by Mr. M. A. Dickinson, of West Swanzey, N. H., so designed as to hold its position firmly at all times. This permits one to hang his hammock at any place he wants to, without regard to the location of trees or other fixed supports. Also, if desired, one end of the hammock may be supported by a tree and the other end by one of the new supports. The latter comprises a socket piece formed with a coarse thread which adapts it to be screwed into the ground, offering considerable resistance to displacement. A post is seated in this socket piece and secured by a bolt. A bracket is fastened to the top of the post, and another to the lower end. Three struts are connected to the upper bracket, and their outer ends are hinged to spreaders carried by the lower bracket and lying along the ground. The struts are permitted a certain amount of play in the upper bracket and may be clamped to such position as to adjust the device to irregular ground. A substantial support is thus given to the post. If one wishes to remove the posts this may be readily done without disturbing the sockets. This is of advantage in cases where the hammock is supported on a lawn, for the posts may be readily removed to permit mowing the grass and afterward as readily set up again.



SUPPORT FOR HAMMOCKS.

A SIMPLE DOOR CHECK.

The purpose of the simple device illustrated in the accompanying engraving is to hold a door at any desired opening, or to permit it to close slowly without slamming. The door check consists of a rubber cushion applied to the door in such a way that it bears on the floor under control of the spring. This spring is shown at 1 in the engraving, and the rubber cushion is attached to the block, 2, which is mounted to slide in a box fastened to the door. The lower arm of the spring 1 passes through an opening in the block 2, so that when the upper arm is depressed the rubber cushion is forced down onto the floor. To hold the cushion in this position a locking device, 3, is provided, which consists of a rack with inclined teeth, adapted to engage the upper arm of the spring. An auxiliary spring, 4, is provided which passes under the arm, 1, and is fastened to the stud that carries the main spring. This auxiliary spring serves to lift the cushion from the floor when the spring arm is released from its rack. The device is set by pressing down the spring arm with the foot. The pressure on the floor or carpet depends upon which one of the rack hooks is engaged. Thus the device may be regulated either to hold the door firmly open, or to permit it to gradually close. When the door is closed, the device may be forced tightly into engagement with the door sill, thus forming an auxiliary lock. A patent on this novel door check has been granted to Mr. Charles McGinnis, El Paso, Texas.



A SIMPLE DOOR CHECK.

Brief Notes Concerning Patents.

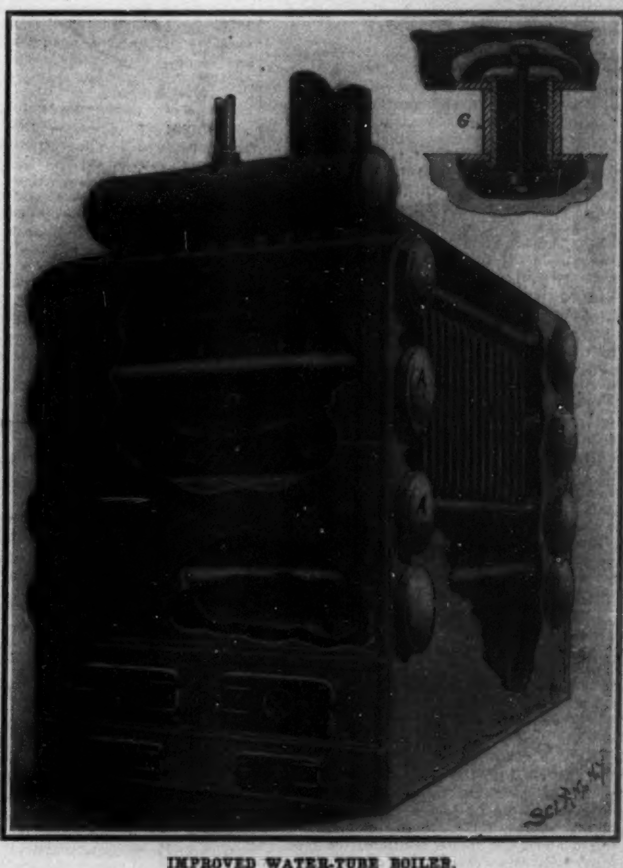
Train markers of bunting have been the rule for a great many years, but there is now possibility that these will be entirely supplanted by markers of metal, which are said to be much more satisfactory from several standpoints. Such a flag has been invented by Conductor J. Landers, of the Canadian Pacific Railroad, and after having been given a test in actual use, is being adopted by the company and will be placed on all trains. Such a signal can be seen and read a much greater distance than the bunting ones, for the reason that it is always in the best position for the trainmen to see. As the trains grew in length, with the use of heavier and more powerful engines, the trouble of making out the signals became a serious matter with the railroad men, but with the metal signal there is little or no difficulty. It has been recently announced that the same scheme is about to be adopted on the Southern Pacific line; and for the purpose of encouraging the employes of the company to exercise their ingenuity, the general manager has offered a prize of fifty dollars for a device that will answer the requirements and prove acceptable to the company. Besides the prize, the company will assume the costs of having the device properly patented, and will give the inventor the right to make use of it wherever he can find a market, but the company reserves the right to make use of it on the trains of its own line for all time. In this connection a standard with two flags has been invented for use on engines. The marker here is always green or white, and the color displayed can easily be changed by swinging one of the metal flags all the way around. Means are provided on the standard for locking the flags in place, to prevent their being tampered with.

So simple a matter as the sanding of the tracks of a railway company has given the management of railway companies a great deal of annoyance. All sorts of devices for accomplishing this purpose have been suggested and tried, but nothing has been arrived at which is said to do the work in a manner entirely satisfactory. It would seem an easy thing to devise some attachment of this character, but not so. A box secured to some convenient part of the car to hold the material, and supplied with an outlet controlled by some simple form of valve, might be supposed to fill the bill, but this is open to many objections, the principal one of which is that in this arrangement the sand cakes and refuses to flow at the critical moment. An entirely new idea in this direction is being experimented with by the Schenectady Railway Company. This consists of a brick composed of sand and rosin secured to the running gear of the car, and at such times as it is desired to sand the tracks, the brick is forced up against the wheel, and a sufficient quantity is thereby pulverized and scattered along the rails. When the brick has been worn away, it is replaced by another.

In order to promote and continue the valuable work accomplished by Prof. Flinders Petrie in his excavations in Egypt, it is intended to establish a British School of Archæology in Egypt upon a permanent basis. It is not considered that a central building such as exists in Athens or Rome is necessary, as it is realized that the most suitable place for training the students is upon the spot where the excavations are being carried out every year. An influential committee has been organized to supervise the task of establishing the school, and the sum required annually is approximately $7,500. The school will constitute a ramification of the general development of research work in the expansion of the University of London. The scope of the object is to promote the continuance of Prof. Petrie's work, and to train the students in historical research.

IMPROVED WATER-TUBE BOILER.

Several months ago we published a description of a water-tube boiler invented by Mr. J. M. Colman, of Everett, Wash., Box 277. This boiler has since been greatly improved by the inventor, and the accompanying engraving shows the present construction, which has just been patented by Mr. Colman. The object of the new form is to reduce the cost of manufacture and to increase the effectiveness in operation. The boiler is formed with the usual headers, *A*, and inclined side tubes, *B*. It will be observed that the headers are arranged in vertical alinement instead of forming an inclined row, as in the previous construction. In addition to the side tubes, a series of small tubes extends across from header to header. The weight of the boiler is carried by four tubes, *C*, which stand at the sides of the grate. These legs communicate with the side tubes, *B*, and form water-protected supports for the boiler. There are only three tubes, *B*, at each side of the boiler, a space being allowed between the top side tube and the one directly below, which is sufficient to receive an additional side tube, if desired. But instead of that, the inventor has provided a central tube, *D*, and connected it with the adjacent side tubes by means of small tubes, *E*, extending diagonally across the boiler. Thus a greater heating surface is secured. The upper side tubes are connected by a series of tubes, *F*, while a series of shorter tubes connects each side tube or header and the one immediately above it. Special attention is directed to the strengthening device for these short tubes, which is shown in the detail view. A ferrule, *G*, is mounted upon the outside of each tube, *J*, and the large tubes or headers are effectively held apart by the ferrule. A rod or bolt passes through each short tube, *J*, and, by means of spiders, *H*, and a tightening nut this bolt is adapted to securely hold the upper and lower tubes together. It will be seen that an adequate connection is secured among the several large tubes and headers of the boiler, and that a great amount of heating surface is provided. The steam formed in the various tubes is not impeded in any way, but naturally collects in the upper header, whence it passes up to the steam dome. An important feature of the device is the provision of manholes in the ends of the headers, side tubes, and steam dome. This provides for the ready inspection and cleaning of the various parts of the device. Provision is also made for firing from either end or from both at the same time, so that the firing end can be changed at will to suit convenience or for blowing out soot from all sides.



IMPROVED WATER-TUBE BOILER.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

DOUBLE JACK FOR TELEGRAPH-CIRCUITS.—O. Johnson, Conway Springs, Kan. The more particular object of this inventor is to provide a plurality of circuits or parts of circuits, so as to throw one set of instruments out of commission and another into commission. He so arranges the instruments and wiring that a telegraph operator by merely inserting a plug in a jack can shift parts of both the main and local circuits from sending and receiving instruments located upon one table to other sending and receiving instruments upon another, all instruments being connected by a common relay.

MAGNET-CONTROLLED THIRD-RAIL SYSTEM.—H. J. Palmer, Philadelphia, Pa. In this case the more particular object is to produce a system in which improved mechanism controllable automatically by a magnet is used for the purpose of temporarily completing the circuit. The invention also refers to certain improvements in mechanism to be mounted upon a movable vehicle for the purpose of governing the contact mechanism for supplying current to the motors of the vehicle.

Of General Interest.

LIFTING APPARATUS FOR DEEP WELLS.—F. J. Moser, Kane, Pa. In Mr. Moser's patent the invention has reference to lifting apparatus for deep wells and the improvement admits of general use, but is of a peculiar value in such regions where it is desirable to raise oil or liquids from considerable distances below the surface.

MOTHPROOF BAG.—G. M. D. Manahan, New York, N. Y. The object of the present invention is to provide a bag perfectly mothproof and air-tight and provided with garment-supporting means arranged within the bag for supporting garments therein, the means extending to the outside of the bag to permit suspending the latter and its contents from a hook or other support, thus relieving the material of the bag of all undue strain, and insuring long life to the bag. The invention relates to moth-proof bags such as shown and described in the Letters Patent of the United States formerly granted to Mr. Manahan.

BOX-LID HOLDER.—G. Loos, Grafton, N. D. This device holds a box-lid in an open position. The invention is especially applicable to cigar-boxes. It is easily applied to boxes of various thicknesses by reason of the construction employed for grasping the box end, and the device may be applied to either end of the box with equal facility. It may be operated to hold a lid in any position desired.

MEASURING DEVICE FOR SHOE-LASTS AND FOOT-COVERINGS.—G. Engelhardt, Cassel, and C. F. Fölsch, Wernigerode-on-the-Harz, Germany. The object of this invention is the provision of a new and improved measuring device for shoe-lasts and foot-coverings arranged to permit of obtaining the proper position of the toe portion relative to the main or heel portion of the wearer's foot.

DRINKING-STRAW.—W. H. Dewender, New York, N. Y. The invention pertains particularly to improvements in straws or tubes designed for convenience in drinking liquid from a bottle, the object being to provide a straw or tube designed to extend to the bottom of the bottle and having thereon a closure for the bottle-mouth to prevent the entrance of dust or other matter floating in the air.

COMBINED CANE AND TRIPOD.—W. F. Clark, St. Louis, Mo. One object of this improvement is to provide a construction for a tripod which enables it to be very closely folded and when folded simulates the form of a walking-cane. The tripod facilitates the use of a camera by tourists and others where the portage of the usual tripod is burdensome and otherwise objectionable, and the device may be utilized as a movable support for music-sheets or a book.

PACKING-CASE.—T. H. Clement, Jr., Port Lavaca, Texas. The invention refers to packing and shipping cases, and is intended especially to receive oysters. The object is to produce a case in which the oysters may be conveniently carried, so that ice may be packed around the vessel containing the oysters to preserve them while stored away or while being shipped. The receptacle will contain a large quantity of oysters without subjecting them to great pressure.

ROOF-CLIMBER.—J. S. Baker and C. F. Ketchum, Cornish, Ind. Ter. This device is adapted to be attached to the feet to enable the wearer to walk or otherwise support himself upon shingle or other sloping wooden roofs. By means of this device the use of wooden brackets or scaffolds may be dispensed with for the purpose of supporting the wearer on sloping roofs, and thereby a great economy of time and labor effected in the shingling or repair of roofs.

GARMENT-FASTENING.—J. Bischof, Boston, Mass. In the use of many of the ordinary hook-and-eye fastenings for garments and the like it frequently happens that the cloth beneath the eye becomes worn by movable contact therewith of the bill or other portion of the hook, resulting sometimes in the eye becoming detached from the cloth and in nearly all cases necessitating patching, both to repair worn spots and to provide a reinforce by which to again secure the eye in place. One of the principal objects is to overcome in this invention the above mentioned objections.

HEATING-FURNACE.—W. N. Best, Los Angeles, Cal. This invention relates particularly to improvements in furnaces for annealing portions of armor-plate where holes are to be drilled, for heating patches of metal, so that the same may be readily bent to form a perfect fit, and also for brazing and other purposes where intense heat is required, the object being to provide a furnace that may be conveniently handled and in which a cheap grade of fuel may be quickly volatilized—such, for instance, as water-gas tar, coke-oven tar, crude oil, or residuum oil, that are not so easily volatilized as gasoline, coal-tar, or naphtha.

SAW.—J. Baumgartner, Silverton, Ore. This is an improvement in saws, being in the nature of a combination hatchet and saw. The inventor utilizes the head of the hatchet as a support for the device for securing the butt-end of the saw-blade and the butt-end of the handle as a support for the swinging carrier for the other end of the saw-blade and also constructs the handle of the saw to form a receptacle for the saw-blade and the swinging carrier when the saw is adjusted out of position for use.

HAND OIL-CAN.—G. H. Thomas, Elmira, N. Y. More especially the invention has reference to oil-cans (commonly known as "squirt-cans") of the type ordinarily employed by mechanics and others for applying oil to the working parts of machinery to lubricate the same. Parts may be separated the one from the other either for the purposes of cleansing or repair and the device possesses many advantages in points of simplicity, convenience, and economy.

Hardware.

BUCKLE.—L. Sanders, New York, N. Y. The purpose in this invention is to provide a simple and durable form of buckle particularly adapted for use in connection with the back straps of trousers, vests, and like garments, but which may be otherwise employed, and to so construct the buckle that it will be practically flat, comprising but two parts—a tongue and a frame—and which two parts have supporting and locking engagement when the buckle is locked upon a strap.

PIPE-WRENCH.—G. Foggan, Pleasantville, Pa. This invention is a pipe-wrench of that class wherein the pipe is encircled and gripped by links pivotally connected together and to a handle, by the swing of which the requisite pressure is applied to grip and turn the pipe. It is characterized by few and simple parts and quick and powerful action and freedom from some defects incident to known constructions.

Heating and Lighting.

GRATE.—J. Wood, Noroton, Conn. This invention relates to a rotary grate adapted particularly for house heating-stoves, but useful in connection with stoves and furnaces of all types. It resides particularly in a certain peculiar arrangement of the rocker-bar on which the rotary grate is mounted and by means of which the grate is turned into dumping position, this bar coacting with the pinion for rotating or turning the grate to shake the same. It also resides in a peculiar lock device for the rocker-bar.

Household Utilities.

CHAIR SEAT OR BACK.—G. B. Mullen and T. P. Mullen, New York, N. Y. In this instance the improvement has reference to chairs and analogous furniture, the more particular object being the provision of a removable member which may be used either as a seat or as a back and furnishing certain constructional advantages.

COMBINED DOOR HOLDER AND BUFFER.—J. A. Ross, Elgin, Utah. The object of the present invention is the provision of a novel simple door-holding device which may be instantly converted into a buffer adapted for contact with a wall when the door is swung open, and thus prevent injury to the door and wall.

Machines and Mechanical Devices.

MANUFACTURE OF WALL-COVERINGS.—T. Cleary, Schuylerville, N. Y. In this patent the object of the inventor is the provision of certain new and useful improvements in the manufacture of wall-coverings, whereby a highly ornamental crushed plush or crushed velvet effect is produced in an exceedingly simple and economical manner.

MACHINE FOR PRODUCING PLUSH EFFECTS ON WALL-COVERINGS.—T. Cleary, Schuylerville, N. Y. In this invention the aim of the inventor is to provide a new and improved machine more especially designed for producing a highly-ornamental plush effect on wall-coverings in an exceedingly simple and economical manner. This is a division of the application for improvements in the manufacture of wall-coverings formerly filed by Mr. Cleary.

LAWN-MOWER.—J. N. Bryant, Sparta, Tenn. In this mower there is a longitudinal frame supported at about its center by an arched frame portion having running wheels. A reciprocating cutting mechanism is provided at the front end of the frame and this may be driven either by hand through suitable driving connection through the rear end of the frame or the shaft of the cutting mechanism may be thrown into gear with toothed rims or annuli on the wheels; a novel form of gearing being provided for this purpose.

WASHING-MACHINE.—H. Plagmann, Davenport, Iowa. In use of the machine the tub is first fixed against movement. Raise the cover-section, and means provide for introduction of water mixed with a detergent and articles to be washed. Close the cover, connect link, throw lock off the tub and it is oscillated upon its trunnions by moving the lever. As the sector carrying the gear-teeth is attached to a relatively fixed point through the link system, the pinion upon the interior shaft is caused to travel past the gear and by its engagement rotates the shaft. This revolves attaching-pins, which moves contents about the tub, rubbing articles against a projection and tub-walls. At the same time circulation of cleaning liquid is produced by swaying motion of the tub.

CARTON MAKING AND SEALING MACHINE.—R. Sunderman, Buffalo, N. Y. This invention relates to machines for making and sealing cartons, and has special reference to a machine provided with instrumentalities by which flattened carton shells or tubes may be expanded or opened, then formed into a carton by folding and securing flaps at the bottom of the shell or tube, and the cartons finally closed and sealed after they have been filled.

PULVERIZER.—N. Spurgin, Ottawa, Ill. In use a beater-shaft is rotated and material introduced through a feed-chute. Beaters hurl it against rings, which present a large pulverizing-surface, toothed faces of upper ring-sections furnishing a reducing-surface. As particles fall they will be again and again struck by the beaters, dividing them until of such size as will pass through spaces between the rings, when they are received by the casing and directed by the hopper to a receptacle. This reduction progresses as material is advanced by the inclined blades, and before it reaches a discharge chute it will be in such a state of division that all will have passed into the casing except pieces of stone or iron, which will be delivered separately.

BUTTER-CUTTER.—W. H. Roussel, San Francisco, Cal. Mr. Roussel's invention pertains to apparatus for cutting such substances as butter, it being especially adapted for the division of large masses of material into cubes of a generally marketable size. Its principal objects are to provide a simple, durable, and effective cutting apparatus. It is entirely free from gearing and elements liable to get out of order, the cord being durable and if broken cheaply replaced.

Pertaining to Recreation.

GUN.—I. A. Tomasini, Guadaloupe, Cal. In operation when the rear trigger is pulled the plunger is withdrawn from the notch in the lug, allowing the gun to break. The breaking turns the rocking lever and pulls the sliding plate forward, thus cocking the hammer. The gun-barrels are then returned to their proper position with respect to the frame and the gun is ready for action. It may be fired much quicker than the ordinary two-triggered gun and the trigger forms a simple yet efficient locking means for holding the barrels and frame in alinement.

Pertaining to Vehicles.

CART.—A. W. Ransome, New York, N. Y. This improvement relates particularly to a cart intended to be manually propelled and useful for carrying plastic concrete and other materials. Its principles may, however, be embodied in a horse-drawn cart. It is particularly intended for concrete work where materials have to be dumped from the cart on both horizontal surfaces and over the brink of scaffolds or pits and excavations. The inventor's object is to provide a cart which may be readily converted from one intended for use in dumping on horizontal surfaces to a cart well suited for dumping into excavations.

SANDING DEVICE FOR AUTOMOBILES.—A. L. Moss, Sandusky, Ohio. In the present patent the object of the inventor is the provision of a new and improved sanding device more especially designed for automobiles and similar vehicles to prevent the same from slipping while traveling over wet or slippery streets or roadways.

STEERING MECHANISM.—W. K. Cleveland, St. Petersburg, Fla. In this steering mechanism the drive shaft of the vehicle consists of a central section and two end sections coupled thereto by means of a universal joint. A sleeve is carried on each end section and these sleeves are connected to the steering gear. The wheels which are also carried on the end sections can thus be moved to steer the vehicle.

Railways and Their Accessories.

RAILROAD-TIE.—E. S. Regler and H. Wittmann, Cincinnati, Ohio. In constructing a road the ties are placed in position on the roadbed, the rails laid thereon, and the securing-plates are inserted into the ties, after which the keys driven into the plates through the outermost openings. The tie may be then filled with concrete through the central openings and the imbedding-concrete placed in position around the same. The large extent of supporting-surface provided by the extensions reduces to a considerable extent the number of ties required for supporting the rail. Approximately sixteen wooden ties are used on a thirty-foot rail; on this only twelve are needed to furnish a like support.

SAFETY-BRIDGE FOR CARS.—H. Alsop, Chicago, Ill. The invention has reference to an improvement in safety bridges and guards for cars, more particularly stock-cars, and has for its object to provide a simple, cheap, and efficient service for loading and unloading stock and other cars and one which can be readily applied to cars now in use, as well as to new cars.

SWITCH-OPERATING DEVICE.—W. E. Hubbard, Dennis, Texas. Mr. Hubbard's invention relates to the automatic operation of switches by moving trains, and comprises means for accomplishing this purpose in an efficient and thoroughly reliable manner without resorting to such expensive and complicated devices as have usually been proposed for this purpose.

Designs.

DESIGN FOR A HAND-MIRROR OR SIMILAR ARTICLE.—S. A. Keller, New York, N. Y. The front face of the hand-mirror in this design shows a frame of circular form gracefully terminating in a handle in length about the diameter of the circle. The frame front and back is made beautifully ornamental by arrangements of flowers and leaves.

DESIGN FOR A FOUNTAIN-PEN HOLDER AND TRAY.—M. A. Benziger, New York, N. Y. Mr. Benziger has invented a new, original, and ornamental design for a fountain-pen holder and tray. The tray is oblong with rounded ends from each of which a foot extends. Four holders of different sizes are inserted in the tray in a slanting position to receive fountain-pens.

Note.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 7644.—For manufacturers of lathes for the making of boat oars.

For mining engines. J. S. Mundy, Newark, N. J.

Inquiry No. 7645.—For manufacturers of celluloid articles.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 7646.—For manufacturers of stump-pulling apparatus.

Drying Machinery and Presses. Biles, Louisville, Ky.

Inquiry No. 7647.—For manufacturers of serviceable portable engines suitable for sawing, etc.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 7648.—For manufacturers of wire bookshelves.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 7649.—For manufacturers of malleable glass suitable for holding fish.

Wanted.—Purchaser for Monazite, Molybdenite and Wolfram. Apply Monazite, Box 773, New York.

Inquiry No. 7650.—For manufacturers of machinery for making excelsior.

I sell patents. To buy, or having one to sell, write Chas. A. Scott, 719 Mutual Life Building, Buffalo, N. Y.

Inquiry No. 7651.—Wanted, address of persons dealing in or manufacturing square steel tubing.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Machine Company, Foot of East 138th Street, New York.

Inquiry No. 7652.—For manufacturers of small experimental apparatus to order.

Wanted.—Ideas regarding patentable device for water well paste or mucilage bottle. Address Adhesive, P. O. Box 773, New York.

Inquiry No. 7653.—For manufacturers of knitting machinery for making hosiery; also machinery for making yarn for same.

I have for sale the U. S. and all foreign rights of new patent improvements in Water Tube Types of Boilers. Great economizer. J. M. Colman, Everett, Wash.

Inquiry No. 7654.—For manufacturers of carding machines.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery tools and wood fibre products. Quadriga Manufacturing Company, 18 South Canal St., Chicago.

Inquiry No. 7655.—For manufacturers of porcelain ware.

Wanted.—A man of experience; capable of running a factory that is manufacturing heavy machinery. Should have $25,000 to invest in the business which can be shown to be profitable. We don't want the money without the man. The experienced man is the first essential. Address Heavy Machinery, Box 117, Station A, Hartford, Conn.

Inquiry No. 7656.—For manufacturers of soap-moulding presses.

Inquiry No. 7657.—Wanted, address of party dealing in elaterate bitumen.

Inquiry No. 7658.—For manufacturers of machinery for working quarry of marble, sawing, turning and finishing marble work.

Inquiry No. 7659.—Wanted, address of Diamond Bell Co., manufacturers of Eagle Auto Bell.

Notes and Queries.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(9865) W. S. asks: 1. Why is twilight so much longer in England than in Spain or North Africa? Is it true that the period of twilight increases as we approach the poles, and if so, what is the cause of the increase? A. Twilight lasts till the sun is about 18 deg. below the horizon in the evening at any place. The sun in the torrid zone descends vertically in setting, and the duration of twilight is least in this region of the earth. The sun traverses 18 deg. in 1 hour and 12 minutes, which consequently is the shortest duration of twilight in the torrid zone all the year. The path of the sun makes the least angle with the horizon in the northern hemisphere in the summer, and hence a longer time is required to bring the sun 18 deg. below the horizon. Twilight then lasts about 2 hours in latitude 40 deg. north. On the Arctic circle the sun at the summer solstice just touches the northern horizon, and daylight lasts through the 24 hours. There is no night. At the north pole twilight is about 2½ months, or from the middle of January to March 22, when day begins. Duration of twilight can be calculated for any latitude at the sea level by trigonometry. At high altitudes above the sea twilight is said to be of shorter duration than at lower altitudes, due probably to the clearness of the air from dust. We have seen it stated that it is not more than twenty minutes at Quito. 2. Is there any means of determining the voltage and amperage of a current after passing through a Ruhmkorff's coil? Could you give approximately an idea of the voltage and amperage of a current which has passed through a coil that yields a spark of six inches, and that is worked by seven Grove cells (ordinary size)? A. The voltage required to force an electric discharge through air has been determined for various conditions. It is found to be different between needle points from what it is between balls. It varies also with the size of the balls. Between sharp points about 20,000 volts are represented in a spark one inch long, while for six inches about 72,000 volts are required. These voltages have been determined by experiments with alternating currents. With direct currents also many tests have been made, using batteries giving enormous pressures. 3. When lamps are lighted by electricity from alternate-current dynamos, how is it that the light appears constant and does not seem to flicker? I suppose commutators cannot be used with continuous-current dynamos. In the alternate-current machine does not the current enter the lamp alternately by opposite wires? A. An alternating current is the result of an alternating electromotive force, which is conceived to start from zero and rise to its highest point of voltage, then to fall through zero to a point as far below zero as it rose above zero, after which it returns to zero, thus making a cycle of changes. The polarity of the current is reversed while the E. M. F. is below zero. The fluctuation of lamps is not visible under such a current, because the changes are more rapid than the eye can take note of. The shortest interval of time the eye can note is about a tenth of a second, while the alternating current passes through 30 to 60 cycles per second. A commutator can be used with a continuous-current dynamo whose voltage is not too high and current is low enough. The transformation of a direct to an alternating current is usually made by a rotary converter or a motor dynamo. We furnish Sloane's "Electrician's Handy Book," which discusses all such matters, for $3.50 by mail.

(9866) C. O. B. writes: I send you this letter with inclosed salt formation, in the hope that I may get some explanation, published or otherwise, as to its cause. A. You inclose a very nice crystal of common salt, which is known in chemistry as sodium chloride. If you will dissolve some table salt in water and set the dish in a quiet place, such crystals will begin to form as soon as the solution becomes saturated by the evaporation of water. The crystal of common salt is a cube when it is formed without interference. Sometimes little baskets of crystals form, and float on the surface of the water, and are very beautiful when seen under a magnifying glass. The repetition of such experiments is very instructive and entertaining to the young people of a family.

(9867) J. E. W. asks: 1. If at the equator a hole 2 feet wide pierced the earth through its center, and a ball a half inch in diameter were dropped into the hole, I figure that in about nine and one half seconds, and at a depth of about 1,440 feet the ball would impinge against the east side of the hole, because at that depth the earth would be revolving a little over one-tenth of an inch slower than at the surface; and from that point down to the center the continually decreasing speed of revolution would cause the ball to press continually against the east side. Supposing, now, that there were neither air nor friction to retard the ball, would it acquire the same velocity as if it could have fallen without touching the side; and would it rise again to the opposite surface of the earth? A. The best experiments to determine the easterly deviation of falling balls, according to Prof. Young in his "College Astronomy," showed from 160 trials, a deviation of 1.12 inches in a fall of 520 into a mine. If a ball were dropped into a hole in the earth it would in time come against the side of the tube and roll down to the center of the earth and pass some distance beyond the center. How far no one can tell, since it depends entirely upon the degree of friction upon the sides of the hole. It could not rise as far as it had fallen, since it could not pass the center with the full velocity due to free fall. 2. If the earth were a hollow sphere inclosing a vacuum, and a rock fell from the inner side, would it not gradually assume a convolute course till it reached a point where its increasing momentum would equal the earth's decreasing attraction, and at that point begin to revolve in a circular orbit? If so, at what depth would this occur? A. If the earth were a hollow shell a rock which had become detached from its interior surface could not fall at all. A body anywhere within such a shell is equally attracted in all directions and has no weight. This is usually demonstrated in text books of mechanics. 3. In such a sphere a ball falling from either pole would go to the center direct and rise again to the opposite pole; but if as in the case of the earth, the poles themselves had a slight rotatory motion in space, would not the ball be gradually deflected into a circular orbit? A. A ball falling along the polar axis of the earth would not be deviated at all in the time required to fall from the surface to the center of the earth, since the deviation of the pole is very slow and very small.

NEW BOOKS, ETC.

DYNAMO, MOTOR, AND SWITCHBOARD CIRCUITS. By W. R. Bowker, C.E. New York: D. Van Nostrand Company, 1904. 8vo.; pp. 120. Price, $2.25 net.

The present work is not intended as a theoretical textbook, but is intended as a practical handbook for electrical engineers and artisans. The diagrams are conspicuous by their great clarity.

THE TEMPERATURE-ENTROPY DIAGRAM. By Charles W. Berry. New York: John Wiley & Sons, 1905. 12mo.; pp. 134. Price, $1.25.

Students of thermodynamics will value this treatise by an instructor in mechanical engineering at the Massachusetts Institute of Technology. The subject is dealt with mathematically with the aid of diagrams. It will prove a valuable addition to the literature of the subject.

CONCRETE. Edited by John Black. London: John Dicks. New York: Industrial Publication Company. N. D. 16mo.; pp. 94. Price, 20 cents.

ARTIFICIAL STONE, ETC. Edited by John Black. London: John Dicks. New York: Industrial Publication Company. N. D. 16mo.; pp. 92. Price, 20 cents.

THE DELUGE AND ITS CAUSE. By Isaac Newton Vail. Pasadena, Cal. N. D. 16mo.; pp. 133.

METALLURGIA DELL' ORO. By Emilio Cortese. Milan: Ulrico Hoepli, 1904. 32mo.; pp. 262.

METALLI PREZIOSI. By Antonio Linone. Milan: Ulrico Hoepli, 1901. 32mo.; pp. 315.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending December 26, 1905

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

End gate and shovel board, G. M. Luscombe 808,395
Energy through space, apparatus for the transmission of, A. Artom 808,504
Engine. See Explosive engine.
Engine cylinders, radiators, etc., air-cooling construction for, W. B. Swan 808,490
Engine frames, machine for facing pedestal legs of locomotive, G. T. Moore 808,563
Envelop fastener, E. B. Stimpson 808,489
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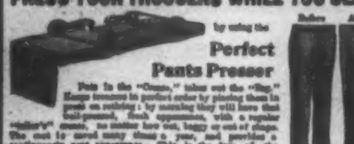

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Meat juice, preparations of, Valentine's Meat Juice Co. 48,359
Medical compound, S. H. E. Hayden 48,441
Medicinal preparations, Leslie E. Keeley Co. 48,429
Medicines, proprietary, L. M. Kasunas 48,418
Medicines, tonic, S. B. Hartman 48,440
Metals, antifriction, E. S. Shimer 48,380
Milk separator, Aktiebolaget Salenius Werkstader 48,338
Nail polishing composition, Dr. J. Parker Pray Co. 48,343
Needles, sewing, C. F. Boker 48,365
Newspaper, trade, David Williams Co. 48,369
Newspaper, weekly, W. C. & F. P. Church 48,407
Oil, olive, F. R. Sari 48,378
Oils for internal and external use, Kickapoo Indian Medicine Co. 48,445
Oiled clothing, A. J. Tower Co. 48,336, 48,337
Orange curacao, Charles Jacquin et Cie 48,339
Organs, Hamilton Organ Co. 48,416
Organs, cabinet, W. W. Kimball Co. 48,435
Packing, Garlock Packing Co. 48,356
Paint and varnish removers, Gould & Cutler Corporation 48,415
Paper and envelops, writing, G. B. Hurd & Co. 48,391
Photographic paper and films, Societe Anonyme "Luna" 48,381
Pulp, International Pulp Co. 48,346
Pulp canal cleansers, R. B. Donaldson 48,413
Razors, Challenge Cutlery Corp. 48,366
Remedies for blood diseases of the mucous surfaces, Rio Chemical Co. 48,424
Remedy for certain named diseases, Finlay, Dicks & Co. 48,414
Remedy for diseases of the blood, A. B. Scutt 48,399
Remedy for diseases of the blood and skin, Dr. Peter Fahrney & Sons Co. 48,444
Rock and rye, Charles Jacquin et Cie 48,323
Saws, E. C. Atkins & Co. 48,370
Sewing machines, Abraham & Straus 48,363
Sewing machines and attachments, Abraham & Straus 48,362
Skirts, G. Plonsky & Bro. 48,372
Soda, washing, Alden Speare's Sons Co. 48,426
Steel, Crucible Steel Company of America .... 48,304 to 48,307
Steel, Singer, Nimick & Co. 48,334
Steel, Park Steel Co. 48,349, 48,350
Steel, Crucible Steel Company of America 48,368
Tamales, enchiladas, frijoles, and chili con carne, Spanish-American Food Co. 48,382
Tapioca, prepared, Whitman Grocery Co. 48,387
Tinters for mortar or plaster compounds, Toch Brothers 48,433
Tires, bandages, repair sheets, plasters, and patches, Continental Caoutchouc Co. 48,342
Tonics, Rio Chemical Co. 48,423
Umbrellas, W. H. Rich & Son 48,353
Valves, F. A. Murray 48,395
Valves and cocks, A. B. Jenkins 48,373
Varnish stains, Glidden Varnish Co. 48,401
Veterinary remedy, D. Binkley 48,437
Water and stain proofing liquid, Toch Bros. 48,432
Waters, aerated, A. C. Schuyler 48,354
Whisky, A. Breslauer Co. 48,301
Whisky, Colburn, Birks & Co. 48,303
Whisky, Jesse Moore Hunt Co. 48,310
Whisky, Kirsch Bros. & Co. 48,311
Whisky, Lang, Schenck & Co. 48,312
Whisky, William H. Lee & Co. 48,314, 48,315
Whisky, L. & A. Scharff 48,316, 48,317
Whisky, B. Fischer 48,324
Whisky, J. & A. Freiberg 48,325
Whisky, Goodman Bros. 48,326
Whisky, H. Kahn 48,329
Whisky, Kaufmann Bros. & Co. 48,331
Whisky, Shea-Bocqueraz Co. 48,333
Whisky, Taylor & Williams 48,335
Whisky, National Distilling Co. 48,348
Whisky, Colburn Birks & Co. 48,367
Whisky, Kamp Distilling Co. 48,374
Whisky, Mallard Distilling Co. 48,376
Whisky, A. Breslauer Co. 48,388
Whisky, J. Harbinson 48,390
Whisky, Montana Liquor Co. 48,393
Whisky, C. Mundy 48,394
Whisky, T. Pepper's Sons 48,396
Whisky, J. S. Perrine & Son 48,397
Whisky, J. Rauber & Co. 48,398
Whisky, Wm. H. Holmes Co. 48,406
Whisky, Jesse Moore Hunt Co. 48,417
Whisky, J. M. Davis 48,438
Wire cloth, netting, and fencing, woven, Clinton Wire Cloth Co. 48,302

LABELS

"Art," for cigars, J. F. Wilcox & Co. 12,572
"B. & O. Central," for cigars, J. Markovitz 12,570
"Ben's Brilliant Beer," for beer, N. Benjamin Son 12,577
"Colombo Bitters," for medicine, Dr. C. De Pellee 12,574
"Fernet Ricca," for bitters, Chas. Jacquin et Cie 12,575
"Forjada," for tea, C. F. Pesbergh & Co. 12,578
"Germ Flake," for pancake flour, Barrows Milling Co. 12,579
"Hot Stuff," for a tonic and relish, S. W. Noggle Wholesale & Mfg. Co. 12,576
"Hubtip," for lacings for boots and shoes, F. W. Whitcher 12,585
"Masetto," for cigars, Magidson Bros. 12,573
"Paris Antiseptic Dental Plaster," for antiseptic plaster, W. Church 12,583
"Polio," for furniture polish, W. W. Wates 12,586
"Posner Bros. Excelsior Dandruff Cure," for hair tonic, Posner Brothers 12,581
"R. Steinecke Co.," for cigars, R. Steinecke Co. 12,571
"Select Pack California Moorpark Apricots," for dried fruit, Castle Bros. 12,580
"Snow-Ball Freezer," for ice cream freezers, Richmond Cedar Works 12,584
"Swamp Chill and Fever Cure," for medicine, Morris Morton Drug Co. 12,582
"True to Nature," for linoleum, P. O. Judson & Co. 12,587

PRINTS.

"Bairam," for cigarettes, S. Anargyros 1,525
"Jayne's Sanative Pills are the best at all times," for pills, Dr. D. Jayne & Son 1,521
"Mecca," for cigarettes, S. Anargyros 1,526
"Murad," for cigarettes, S. Anargyros 1,524
"Star Bathtub Enamel," for an enamel, Gerstendorfer Bros. 1,528
"The Edelweiss Girl," for beer, P. Schoenhofen Brewing Co. 1,523
"The Real Pure Food Show," for flour, Washburn-Crosby Co. 1,522
"Turkish Trophies," for cigarettes, S. Anargyros 1,527

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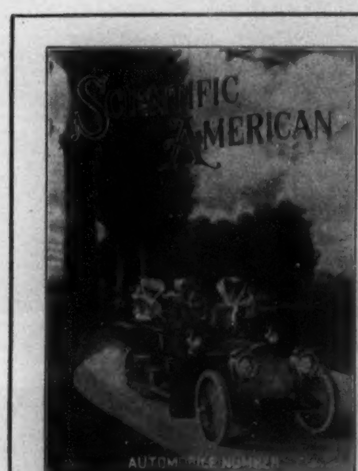

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